

**GAMMA-RAY LARGE AREA
SPACE TELESCOPE
(GLAST)
PROJECT**

**GLAST MOC
Functional & Performance
Requirements Document**

**DRAFT
Version 1.01
July 26, 2004**



**GODDARD SPACE FLIGHT CENTER
GREENBELT, MARYLAND**

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PROJECT

GLAST MOC Functional & Performance Requirements

July 26, 2004

NASA Goddard Space Flight Center

Greenbelt, Maryland

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GLAST MOC FUNCTIONAL & PERFORMANCE REQUIREMENTS

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TABLE OF CONTENTS

1	Introduction.....	1
1.1.	Purpose	1
1.2.	Scope	1
1.3.	Document Organization.....	1
1.4.	Requirements Trace Methodology	2
2	Applicable Reference Documents	3
2.1.	Referenced Documents.....	3
2.2.	Applicable Documents.....	4
3	Requirements	6
3.1.	MOC Configuration and Architecture	6
3.1.1.	Interface.....	7
3.1.2.	Facility.....	12
3.1.3.	Redundancy	15
3.1.4.	Security.....	16
3.1.5.	Database.....	17
3.1.6.	Web Page	18
3.1.7.	Documentation	19
3.2.	Mission Planning & Scheduling.....	20
3.2.1.	Flight Dynamics.....	20
3.2.2.	TDRSS Scheduling.....	23
3.2.3.	Backup Ground Network Scheduling.....	26
3.2.4.	Target of Opportunity.....	27
3.2.5.	Stored Command Load Generation.....	29
3.3.	Telemetry & Command Processing	40
3.3.1.	Telemetry Processing.....	40
3.3.2.	Data Processing	47
3.3.3.	Data Archiving	50
3.3.4.	Alert Telemetry Monitoring.....	52
3.3.5.	User Interface Language	53
3.3.6.	Commanding	55
3.4.	Monitoring & Analysis.....	63
3.4.1.	Ground System Monitoring	63
3.4.2.	Display Pages	65
3.4.3.	Sequential Prints	69
3.4.4.	Event Messages.....	71
3.4.5.	Autonomous Re-pointing	73
3.4.6.	Memory Mapping & Maintenance.....	74
3.4.7.	Limit Monitoring	76
3.4.8.	Configuration Monitoring.....	78
3.4.9.	Trending & Analysis.....	80
3.4.10.	Anomaly Tracking and Notification.....	85
3.4.11.	Timeline Monitoring	90

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Acronyms

APID	Application Identification
AR	Autonomous Re-point
ATS	Absolute Time Sequence
BAP	Burst Alert Processor
CCSDS	Consultative Committee for Space Data Systems
CCL	Closed-Circuit Loop
CLCW	Command Link Control Word
COP-1	Communications Operation Procedure-1
CGS	Common Ground Station
CRC	Cyclic Redundant Checking
CVT	Current Value Table
DAS	Demand Access System
DOWD	Differenced One-way Doppler
ECI	Earth Centered Inertial
EU	Engineering Unit
FDF	Flight Dynamics Facility
FARM	Frame Acceptance and Reporting Mechanism
FOT	Flight Operations Team
FSW	Flight Software
FTP	File Transfer Protocol
GBM	GLAST Burst Monitor
GCMR	Ground Communication Message Request
GCN	Gamma-ray Burst Coordinates Network
GFEP	GLAST Front-end Processor
GIOC	GBM Instrument Operations Center
GLAST	Gamma ray Large Area Space Telescope
GN	Ground Network
GPS	Global Positioning System
GRB	Gamma-ray Burst
GSFC	Goddard Space Flight Center
GSRD	Ground System Requirements Document
GSSC	GLAST Science Support Center
HEASARC	High Energy Astrophysics Science Archive Research Center
HK	Housekeeping
ICD	Interface Control Document
IIRV	Improved Interrange Vectors
IOC	Instrument Operations Center
IONet	IP Operational Network
IOT	Integrated Observatory Timeline
IP	Internet Protocol
IT	Information Technology
I&T	Integration and Test

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Kbps	kilobits per second
KSC	Kennedy Space Center
LAT	Large Area Telescope
L&EO	Launch and Early Orbit
LISOC	LAT Instrument Science Operation Center
MA	Multiple Access
MOC	Mission Operations Center
MOMS	Mission Operations and Mission Services (contract)
MSFC	Marshall Space Flight Center
NASA	National Aeronautics and Space Administration
NCC	Network Control Center
NISN	NASA Integrated Services Network
NORAD	North American Aerospace Defense Command
NPD	NASA Policy Directive
NPG	NASA Policy Guidelines
OIG	Orbital Information Group
PDB	Project Database
PPT	Pre-planned Timeline
PSLA	Project Service Level Agreement
RF	Radio Frequency
RT	Real-time
RTS	Relative Time Sequence
S/C	Spacecraft
SAA	South Atlantic Anomaly
SCAMA	Station Conferencing And Monitoring Arrangement
SLAC	Stanford Linear Accelerator Center
SN	Space Network
SA	Single Access
SSA	S-band Single Access
SSR	Solid State Recorder
SWG	Science Working Group
SWSI	Space Network Web-based Scheduling Interface
T&C	Telemetry and Command
TBD	To Be Determined
TCP	Transmission Control Protocol
TDRSS	Tracking and Data Relay Satellite System
ToO	Target of Opportunity
TLE	Two Line Elements
TUT	TDRSS Unscheduled Time
UPD	User Performance Data
UPS	Uninterruptible Power Supply
USN	Universal Space Network
UTC	Universal Time Coordinated
UTCf	UTC Correction Factor
VC	Virtual Channel
VCID	Virtual Channel Identifier

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VDS	Voice Distribution System
WDISC	WSC Data Interface Service Capability
WSC	White Sands Complex
WWW	World Wide Web

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1 Introduction

1.1. Purpose

The Gamma-ray Large Area Space Telescope (GLAST) Mission Operations Center (MOC) Functional & Performance Requirements Document specifies the Level-4 requirements for the MOC element of the GLAST project. The requirements contained within this document represent the complete set of functional, performance, and capacity requirements by which the MOC will be designed, constructed, and tested.

1.2. Scope

The GLAST MOC provides mission planning & scheduling, command generation, real-time command and telemetry processing, observatory health & safety monitoring and analysis, data processing, and automated pass execution functions for the GLAST system.

For the sake of organization and clarity, many of the requirements in this document have been allocated to one of seven functional groups. The group names and the functions they represent are as follows:

- T&C system – Telemetry and command processing
- Trending System – Data trending and analysis
- Anomaly Tracking and Notification System – Anomaly tracking and notification
- Web Page – Web posting of data products and information
- MPS – Mission planning and scheduling
- Timeline Monitor – Verification of observatory activities
- Flight Dynamics System – Orbit determination and propagation

1.3. Document Organization

The MOC requirements have been organized principally by function. This method minimizes duplication and coupling of requirement functions. The primary categories of organization are as follows:

- MOC Configuration and Architecture
 - Interface
 - Facility
 - Redundancy
 - Security
 - Database
 - Web Page
 - Documentation
- Mission Planning & Scheduling
 - Flight Dynamics
 - TDRSS Scheduling
 - Ground Scheduling
 - Target Of Opportunity

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- Stored Command Load Generation
- Telemetry & Command Processing
 - Telemetry Processing
 - Data Processing
 - Data Archiving
 - User Interface Language
 - Commanding
 - Clock Correlation
- Monitoring & Analysis
 - Ground System Monitoring
 - Display Pages
 - Sequential Prints
 - Event Messages
 - Autonomous Re-pointing
 - Memory Mapping & Maintenance
 - Limit Monitoring
 - Trending & Analysis
 - Anomaly Tracking and Notification
 - Timeline Monitoring
 - TDRSS Message Monitoring

To improve readability, the requirements within each function are organized in chronological (scenario-based) order as possible.

The MOC requirements are presented in a table format with the following column headers:

- Req ID – This column contains the unique identification given to each MOC Level-4 requirement.
- Requirement – This column contains the requirement wording.
- Comments – This column contains any information necessary to clarify the requirement or its context.
- Source – This column contains the document that contains the Level-3 requirement from which the Level-4 requirement was created.
- Source ID – This column contains the identification number of the Level-3 requirement from which the Level-4 requirement was created, if any.

1.4. Requirements Trace Methodology

The GLAST MOC Level-4 requirements have been created to assist in the development of a MOC that is compliant with the requirements in the GLAST System Requirements Document (GSRD). The Level-4 requirements are written as a set of requirements sufficient to allow the MOC to be designed, constructed, and tested. All of the MOC Level-4 requirements originated from GSRD requirements and their intent. Wherever a GSRD requirement exhibited sufficient level of detail and functional independence, the GSRD requirement was preserved in a Level-4 form in a one-to-one ratio. In many cases, minimal wording changes were made to

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promote consistency, clarity, and organization. GSRD requirements that demonstrated an insufficient level of detail or exhibited coupled functions were decomposed into a series of constituent requirements more fitting to the needs of a Level-4 requirements document. Throughout the composition of the Level-4 requirements, close attention was paid so as not to disturb the intent or scope of the original GSRD requirements. In all cases the origin of the Level-4 requirements are recorded in the *Source* and *Source ID* columns of the requirements tables. Wherever a need for a Level-4 requirement was identified and no source GSRD requirement was found, a new Level-4 requirement was created. Each of these requirements is identified by the word *Derived* in the *Source* column of the requirements tables.

2 Applicable Reference Documents

2.1. Referenced Documents

The following documents are referenced in the MOC requirements:

433-RQMT-0006: *GLAST Ground System Requirements Document*, October 15, 2003

NPD 8010.2C: *NASA Policy Directive, Use of the Metric System of Measurement in NASA Programs*, July 2000

GFEP-MOC Interface Control Document

452-UG-SWSI: *SWSI User's Guide*, July 9, 2003

453-ICD-DAS/Customer: *Interface Control Document Between the Demand Access System (DAS) and DAS Customers*, August 15, 2001

NCCDS to MOC Interface Control Document

MOMS-GLAST Project Service Level Agreement

492-MOC-010 *MOC-Backup Ground Station Interface Control Document*

492-MOC-009: *GLAST Operations Data Products Interface Control Document*

CDRL-4 Observatory-Ground Interface Control Document

FDF-MOC Interface Control Document

NPG 2810.1: *NASA Procedures and Guidelines, Security of Information Technology*, October 1998

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CCSDS 102.0-B-5: *Recommendation for Space Data Systems Standards Packet Telemetry, Blue Book, Issue 5*, November 2000

CCSDS 103.0-B-2: *Recommendation for Space Data Systems Standards Packet Telemetry Service Specification, Blue Book, Issue 2*, June 2001

CDRL-6 *GLAST Telemetry and Command Handbook*

CCSDS 201.0-B-3: *Recommendation for Space Data Systems Standards Telecommand Part 1 -- Channel Service, Blue Book, Issue 3*, June 2000

CCSDS 202.0-B-3: *Recommendation for Space Data Systems Standards Telecommand Part 2 -- Data Routing Service, Blue Book, Issue 3*, June 2001

CCSDS 203.0-B-2: *Recommendation for Space Data Systems Standards Telecommand Part 3 -- Data Management Service, Blue Book, Issue 2*, June 2001

CCSDS 202.1-B-2: *Recommendation for Space Data Systems Standards Telecommand Part 2.1 -- Command Operation Procedures, Blue Book, Issue 2*, June 2001

2.2. Applicable Documents

The following documents are listed for reference:

433-SRD-0001: *GLAST Science Requirements Document*, May 30, 2003

433-SPEC-0001: *GLAST Project Mission System Specification*, May 21, 2003

433-MAR-0004: *GLAST Ground Data System Mission Assurance Requirements*

CCSDS 101.0-B-5: *Recommendation for Space Data Systems Standards. Telemetry Channel Coding, Blue Book, Issue 5*, June 2001

CCDS 701.0-B-3: *Recommendation for Space Data Systems Standards Advanced Orbiting Systems, Networks and Data Links: Architectural Specification, Blue Book, Issue 3*, June 2001

NPD 2820.1: *NASA Policy Directive, NASA Software Policies*, May 1998

Recommendation ITU-R SA.1157: *Protection Criteria for Deep-Space Research* (1995)

433-OPS-0001: *GLAST Operations Concept Document*

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451-ICD-NCCDS/MOC: *Interface Control Document Between the Network Control Center Data System and the Mission Operations Centers*, Revision 1 plus DCN 001, June 1999

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3 Requirements

3.1. MOC Configuration and Architecture

Req ID	Requirement	Comments	Source	Source ID
MOC Configuration and Architecture Requirements				
GEN0010	The MOC shall observe the current NASA policy directive, NPD 8010.2C, Use of the Metric System of Measurement in NASA programs.		GSRD	SYS0010
GEN0020	The MOC shall support the observatory during the pre-launch I&T phase.		GSRD	MOC3000
GEN0030	The MOC shall support the observatory launch and early orbit checkout period.	This includes all elements of the ground system. The in-orbit checkout period is expected to be 60 days.	GSRD	SYS0170
GEN0040	The MOC shall support the observatory in the normal mission operations phase.		Derived	
GEN0050	The MOC shall support observatory operations 24hours/day, 7 days/week, and 365+ days/year.	Availability shall be supported by autonomous operation or personnel where applicable.	GSRD	SYS1000 MOC1000, MOC9000
GEN0060	The MOC shall provide a reliability of 99.98% for launch critical functions.	Launch critical functions are defined in Section 1.6 of the GSRD	GSRD	SYS1050
GEN0070	The MOC shall support a single 8-hour by 5-day shift (M-F) approach and shall operate autonomously whenever not staffed.	Operate here means receive and transmit telemetry and send pages if problems are encountered.	GSRD	MOC0030, MOC9000
GEN0080	The MOC shall support automated SN and ground station passes.		GSRD	MOC0030, MOC7010, MOC9000

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Req ID	Requirement	Comments	Source	Source ID
MOC Configuration and Architecture Requirements				
GEN0090	The MOC shall provide the capability to support automated command uploads.	This capability may be necessary for routine dumping of recorder data.	GSRD	MOC0030
GEN0100	The MOC shall provide the capability to support automated playback of recorded data.		GSRD	MOC0030, MOC9000
GEN0110	The MOC shall operate autonomously for at least 96 hours without operator intervention.		GSRD	MOC0030, MOC7020
GEN0120	The MOC shall provide the tools and interfaces necessary to support sustaining engineering of the observatory for the life of the mission.	Including FSW maintenance, loads, special commanding, data analysis and trending	GSRD	SYS0120
GEN0130	The MOC shall be maintained for the entire mission lifetime with no loss in MOC capability or performance.		GSRD	MOC1020

3.1.1. Interface

Req ID	Requirement	Comments	Source	Source ID
Interface Requirements				
General				
INF0010	The MOC shall be the sole interface between the ground system elements and the space-ground communications links.		GSRD	SYS5000
INF0020	The MOC shall be the sole interface for commands between the elements of the ground system and the space-ground communications links.		GSRD	MOC0020

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Req ID	Requirement	Comments	Source	Source ID
Interface Requirements				
INF0030	The MOC shall provide a web interface to authorized users for access to MOC data products.		GSRD	MOC0050
Space Network				
INF0040	The MOC shall interface with the SN for planning observatory contacts.		GSRD	MOC1510
INF0050	The MOC shall interface with the SN for obtaining SN status data.		GSRD	MOC5050
INF0060	The MOC shall interface with the SN for the exchange of observatory commands.		GSRD	MOC1510
INF0070	The MOC shall interface with the SN Web Services Interface (SWSI) for SN contact schedules and status as specified in the <i>SWSI User's Guide</i> .		GSRD	MOC4900
INF0080	The MOC shall interface with the SN/WSC/DAS system for TDRSS telemetry as specified in the <i>ICD between DAS and DAS customers</i> .		GSRD	MOC4900
INF0090	The MOC shall have an interface to the SN/WSC/WDISC system for scheduled TDRSS MA services for telemetry and command as specified in the <i>NCCDS to MOC ICD</i> .		GSRD	MOC4900
INF0100	The MOC shall have an interface to the SN/WSC/WDISC system for TDRSS SSA services for telemetry and command as specified in the <i>NCCDS to MOC ICD</i> .		GSRD	MOC4900

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Req ID	Requirement	Comments	Source	Source ID
Interface Requirements				
INF0110	The MOC shall use a communications link with the IONet at GSFC for access to the WSC as specified in the <i>MOMS-GLAST PSLA</i> .		GSRD	SYS0090
GLAST Front End Processor				
INF0120	The MOC shall interface with the GFEP for the purposes of planning observatory contacts		GSRD	MOC1510
INF0130	The MOC shall interface with the GFEP for obtaining GFEP status data.		GSRD	MOC5050
INF0140	The MOC shall have the ability to remotely configure and control the GFEP as per the <i>GFEP-MOC ICD</i> .		Derived	
INF0150	The MOC shall interface with the GFEP for the exchange of observatory telemetry and data.		GSRD	MOC1510
Ground Network				
INF0160	The MOC shall interface with USN for planning observatory contacts.		GSRD	MOC1500
INF0170	The MOC shall interface with the ground stations for obtaining station status data.		GSRD	MOC5040
INF0180	The MOC shall interface with the ground station network for the exchange of observatory commands and telemetry.		GSRD	MOC1500
INF0190	The MOC shall use communication links with the Backup Ground Station facilities for the communication of telemetry and command data as specified in the <i>MOC-USN ICD</i> .		GSRD	SYS0090
INF0200	The MOC shall use a communications link with the IONet at GSFC for access to USN as specified in the <i>MOMS-GLAST PSLA</i> .		GSRD	SYS0090

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Req ID	Requirement	Comments	Source	Source ID
Interface Requirements				
GSSC				
INF0210	The MOC shall interface with the GSSC for the exchange of mission planning products as specified in the <i>GLAST Operations Data Products ICD</i> .		GSRD	MOC1520
INF0220	The MOC shall interface with the GSSC for the distribution of data products as specified in the <i>GLAST Operations Data Products ICD</i> .		GSRD	MOC1520
INF0230	The MOC shall use a communications link with the GSSC for the communication of mission planning and data products as specified in the <i>GLAST Operations Data Products ICD</i> .		GSRD	SYS0090
INF0240	The MOC shall receive requests for retransmission of observatory data from the GSSC.		Derived	
LISOC				
INF0250	The MOC shall interface with the LISOC for the exchange of mission planning products as specified in the <i>GLAST Operations Data Products ICD</i> .		GSRD	MOC1560
INF0260	The MOC shall interface with the LISOC for the distribution of data products as specified in the <i>GLAST Operations Data Products ICD</i> .		GSRD	MOC1560
INF0270	The MOC shall receive requests for retransmission of observatory data from the LISOC.		GSRD	MOC1530

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Req ID	Requirement	Comments	Source	Source ID
Interface Requirements				
INF0280	The MOC shall use a communications link with the LISOC for the communication of data products as specified in the <i>GLAST Operations Data Products ICD</i> .		GSRD	SYS0090
GIOC				
INF0290	The MOC shall interface with the GIOC for the exchange of mission planning products as specified in the <i>GLAST Operations Data Products ICD</i> .		GSRD	MOC1550
INF0300	The MOC shall interface with the GIOC for the distribution of data products as specified in the <i>GLAST Operations Data Products ICD</i> .		GSRD	MOC1550
INF0310	The MOC shall receive requests for retransmission of observatory data from the GIOC.		GSRD	MOC1530
INF0320	The MOC shall provide a communications link with the GIOC for the communication of data products as specified in the <i>GLAST Operations Data Products ICD</i> .		GSRD	SYS0090
Spacecraft Vendor Facility				
INF0330	The MOC shall interface with the S/C vendor facility for support of sustaining engineering functions.	Sustaining engineering functions to include FSW updates, anomaly resolution, data trending and analysis, and database verification.	GSRD	MOC1570, MOC3000
Observatory				
INF0340	The MOC shall exchange telemetry and command data with the observatory as specified in the <i>Observatory-Ground ICD</i> .		GSRD	MOC1580

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Req ID	Requirement	Comments	Source	Source ID
Interface Requirements				
Flight Dynamics Facility				
INF0350	The MOC shall have an interface with the Flight Dynamics Facility for receipt of orbit and attitude determination related data as specified in the <i>FDF-MOC ICD</i>		GSRD	MOC1590
INF0360	The MOC shall provide a communications link with the IONet at GSFC for access to the FDF as specified in the <i>MOMS-GLAST PSLA</i> .		GSRD	SYS0090, SYS3000
INF0370	The MOC shall have an interface with the NASA Orbital Information Group (OIG) web site to obtain two-line element (TLE) sets		Derived	

3.1.2. Facility

Req ID	Requirement	Comments	Source	Source ID
Facility Requirements				
FAC0010	The MOC shall be located in Building 14 of NASA Goddard Space Flight Center (GSFC) in Greenbelt, Maryland.		Derived	
FAC0020	The MOC facility shall restrict physical access to allow entry to authorized personnel only.		GSRD	MOC0250, MOC0330
FAC0030	The MOC facility shall contain within it console, analysis, and meeting space for the FOT and S/C engineers for the duration of the mission.		GSRD	MOC0260, MOC0330

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Req ID	Requirement	Comments	Source	Source ID
Facility Requirements				
FAC0040	The MOC facility shall contain within it analysis and meeting space for the instrument team engineers during Launch and Early Orbit (L&EO).		GSRD	MOC0260, MOC0330
FAC0050	Each console position shall have a workstation.		GSRD	MOC0330
FAC0060	Each console position shall have access to a voice communications panel.		GSRD	MOC0330
FAC0070	Each voice communications panel shall provide closed-circuit loop (CCL) and public switched telephone network access.		GSRD	MOC0330
FAC0080	The MOC facility shall provide a voice communications system with the capability to connect to the ground stations.	This can be a combination of dedicated (e.g., SCAMA) circuits and commercially-provided circuits (i.e., Black phone)	GSRD	MOC0270, MOC0330
FAC0090	The MOC facility shall provide a voice communications system with the capability to connect to the Kennedy Space Center (KSC) launch site.	This can be a combination of dedicated (e.g., SCAMA) circuits and commercially-provided circuits (i.e., Black phone)	GSRD	MOC0270, MOC0330
FAC0100	The MOC facility shall provide a voice communications system with the capability to connect to the SN.	This can be a combination of dedicated (e.g., SCAMA) circuits and commercially-provided circuits (i.e., Black phone)	GSRD	MOC0270, MOC0330
FAC0110	The MOC facility shall provide a voice communications system with the capability to connect to the LISOC.	This can be a combination of dedicated (e.g., SCAMA) circuits and commercially-provided circuits (i.e., Black phone)	GSRD	MOC0270, MOC0330
FAC0120	The MOC facility shall provide a voice communications system with the capability to connect to the GIOC.	This can be a combination of dedicated (e.g., SCAMA) circuits and commercially-provided circuits (i.e., Black phone)	GSRD	MOC0270, MOC0330

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Req ID	Requirement	Comments	Source	Source ID
Facility Requirements				
FAC0130	The MOC facility shall provide a voice communications system with the capability to connect to the FDF.	This can be a combination of dedicated (e.g., SCAMA) circuits and commercially-provided circuits (i.e., Black phone)	GSRD	MOC0270, MOC0330
FAC0140	The MOC facility shall provide a voice communications system with the capability to connect to the Spacecraft I&T Facility.	This can be a combination of dedicated (e.g., SCAMA) circuits and commercially-provided circuits (i.e., Black phone)	GSRD	MOC0270, MOC0330
FAC0150	The MOC facility shall provide a voice communications system with the capability to connect to and the GSSC.	This can be a combination of dedicated (e.g., SCAMA) circuits and commercially-provided circuits (i.e., Black phone)	GSRD	MOC0270, MOC0330
FAC0160	The MOC facility shall provide UTC clock and countdown clock displays.		GSRD	SYS0040, MOC0280, MOC0330
FAC0170	The MOC facility shall provide unobstructed visibility to UTC clock and countdown clock displays from each console position.		GSRD	MOC0330
FAC0180	The MOC facility shall provide an uninterruptible power supply (UPS) to all the MOC systems.	This is to provide the opportunity to gracefully shutdown non-critical functions and allow backup power to be supplied.	GSRD	MOC0300, MOC0330, MOC0340
FAC0190	The MOC facility shall access a backup power capability in the event of a utility power outage.	Current plans are to access diesel power in building 14.	GSRD	MOC0310, MOC0330
FAC0200	The MOC UPS shall provide backup power to MOC systems for at least 30 minutes.		GSRD	MOC0330
FAC0210	The MOC facility shall include color printers to generate reports, printouts, and plots as required.		GSRD	MOC0320, MOC0330
FAC0220	The MOC facility shall include black/white printers to generate reports, printouts, and plots as required.		GSRD	MOC0320, MOC0330

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Req ID	Requirement	Comments	Source	Source ID
Facility Requirements				
FAC0230	The MOC facility shall include a white board.		GSRD	MOC0330
FAC0240	The MOC facility shall include an area for posting messages, plots, and other information.		GSRD	MOC0330
FAC0250	The MOC facility shall provide the physical space to host all hardware contained within the MOC.		GSRD	MOC0330, MOC0340
FAC0260	The MOC facility shall provide the power for all hardware contained within the MOC.		GSRD	MOC0330, MOC0340
FAC0270	The MOC facility shall provide the cooling for all hardware contained within the MOC.		GSRD	MOC0330, MOC0340
FAC0280	The MOC facility shall provide the necessary network access to all MOC hardware.		GSRD	MOC0330, MOC0340
FAC0290	The MOC facility shall provide a master time signal for all hardware contained within the MOC.		GSRD	MOC0290, MOC0330
FAC0300	The MOC facility master time shall be in UTC.		GSRD	SYS0040, MOC0330
FAC0310	The MOC facility shall have access to NASA Select.		Derived	

3.1.3. Redundancy

Req ID	Requirement	Comments	Source	Source ID
Redundancy Requirements				
RED0010	The MOC shall provide backup capabilities for all MOC components.		GSRD	SYS9000, MOC9070

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Req ID	Requirement	Comments	Source	Source ID
Redundancy Requirements				
RED0020	The MOC shall perform a manual fail-over to a backup, real-time system within 1 minute of initiation of the manual fail over.	This applies only to MOC systems and not external systems that interface with the MOC.	GSRD	MOC9060
RED0030	The MOC shall perform a manual fail-over to a backup, non-real-time system within 30 minutes of initiation of the manual failover.	This applies to staffed operations only.	GSRD	MOC9080
RED0040	The MOC shall restore backup capabilities after a MOC real-time system failure within 12 hours.		GSRD	MOC9090
RED0050	The MOC shall provide the capability to routinely backup system operational files.		GSRD	MOC9100
RED0060	The MOC shall provide the capability to restore operational files from the backup files.		GSRD	MOC9100

3.1.4. Security

Req ID	Requirement	Comments	Source	Source ID
Security Requirements				
SEC0010	The MOC shall comply with Information Technology (IT) security requirements specified in NPG 2810.1.	This requirement will be satisfied with the Authorization to Process letter.	GSRD	SYS0500
SEC0020	The MOC shall restrict computer access to authorized personnel.		GSRD	MOC0500
SEC0030	The MOC shall maintain user profile data for all authorized users of the system, including username, password, and privileges.		GSRD	MOC0500, MOC0220

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Req ID	Requirement	Comments	Source	Source ID
Security Requirements				
SEC0040	The MOC shall monitor for MOC network security violations.		GSRD	MOC0510
SEC0050	The MOC shall log all network security violations.		GSRD	MOC0510, MOC5350
SEC0060	The MOC shall comply with the security requirements for connecting to the SN data distribution network (IONet) as specified in the <i>IONet Access Protection Policy and Requirements</i> document.	This requirement will be satisfied with the Authorization to Process letter.	Derived	

3.1.5. Database

Req ID	Requirement	Comments	Source	Source ID
Database Requirements				
DTB0010	The MOC shall ingest the observatory telemetry & command (T&C) database provided by the S/C vendor.		GSRD	MOC0400
DTB0020	The MOC shall ingest observatory T&C databases from the instrument vendors.	During operations phase.	GSRD	MOC0400
DTB0030	The MOC shall ingest observatory T&C databases directly from the IOCs for test support.	During I&T	GSRD	MOC3010
DTB0040	The MOC shall accept database updates from the IOCs and incorporate them into the PDB.	This applies to post-launch since the S/C vendor is no longer providing the Observatory Data Base.	GSRD	MOC0430

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Req ID	Requirement	Comments	Source	Source ID
Database Requirements				
DTB0050	The MOC shall verify the observatory T&C databases.	Verification includes syntax level checking of database, Ex. Command mnemonic created expected bit sequence	GSRD	MOC0400
DTB0060	The MOC shall construct the ground segment database to define ground commands.		GSRD	MOC0410
DTB0070	The MOC shall construct the ground segment database to define parameters to be processed by the MOC.	Ground parameters are items such as ground station statistics and ground commands are those needed to control the MOC system.	GSRD	MOC0410
DTB0080	The MOC shall verify the observatory T&C databases.	Verification includes syntax level checking of database, Ex. Command mnemonic created expected bit sequence	GSRD	MOC0400 MOC0410
DTB0090	The MOC shall construct a PDB.		GSRD	MOC0420
DTB0100	The PDB shall contain the observatory T&C databases.		GSRD	MOC0420
DTB0110	The PDB shall contain the ground segment database.		GSRD	MOC0420
DTB0120	The MOC shall provide configuration control of the PDB.		GSRD	MOC0440
DTB0130	The MOC shall provide the capability to install the operational database for use by MOC T&C system from the selected configuration-controlled T&C database		Derived	

3.1.6. Web Page

Req ID	Requirement	Comments	Source	Source ID
Web Page Requirements				

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Req ID	Requirement	Comments	Source	Source ID
Web Page Requirements				
WEB0010	The MOC shall maintain a web page for community access to MOC products.		GSRD	MOC6160
WEB0020	The MOC shall post the Integrated Observatory Timeline on the MOC web page.		GSRD	MOC4240
WEB0030	The MOC shall post the Integrated Observatory Timeline for the last 7 days.		GSRD	MOC4240
WEB0040	The MOC shall post the As-flown Timeline on the MOC web page.		GSRD	MOC4250
WEB0050	The MOC shall post the As-flown Timelines for the last 30 days.		GSRD	MOC4250
WEB0060	The MOC shall post the as-flown timeline covering a 24-hour period within 7 days.		GSRD	MOC6160
WEB0070	The MOC shall post the orbit data products on the MOC web page.		Derived	MOC4650
WEB0080	The MOC shall post the orbit data products for the last 7 days.		Derived	MOC4650
WEB0090	The MOC shall post updates to the MOC web page once per day.		Derived	
WEB0100	The MOC shall provide authorized remote users RT housekeeping data via the WWW.		GSRD	MOC0040
WEB0110	The MOC shall provide simultaneous remote access to observatory telemetry to at least 4 operations personnel.		Derived	

3.1.7. Documentation

Req ID	Requirement	Comments	Source	Source ID
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Documentation Requirements				
DOC0010	The MOC shall store and display electronic documentation of operating procedures to specify the tasks to be performed for routine activities.		GSRD	MOC0200
DOC0020	The MOC shall provide the capability to edit and delete operating procedures.		GSRD	MOC0200
DOC0030	The MOC shall create pass summaries that describe the results of each observatory contact.	This includes selected mnemonics, procedures executed, S/C events, system events, commands sent, and limit and configuration monitor violations.	GSRD	MOC6020
DOC0040	The MOC shall maintain electronic documentation of operating procedures to specify the tasks to be performed for contingency activities.		GSRD	MOC0200
DOC0050	The MOC shall maintain configuration control of the electronic documentation.		GSRD	MOC0210
DOC0060	The MOC shall restrict access to the electronic documentation to authorized operations personnel.		GSRD	MOC0220

3.2. Mission Planning & Scheduling

3.2.1. Flight Dynamics

Req ID	Requirement	Comments	Source	Source ID
Flight Dynamics Requirements				
ORB0010	The MOC T&C system shall create sequential print files containing orbit position data.	GPS data	GSRD	MOC4610

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Req ID	Requirement	Comments	Source	Source ID
Flight Dynamics Requirements				
ORB0020	The MOC T&C system shall create sequential print files containing attitude-related telemetry data.		GSRD	MOC4610
ORB0030	The MOC shall provide orbit and attitude-related sequential print files to the FDF.		GSRD	MOC4610
ORB0040	The MOC shall receive orbit products from the FDF as defined in the <i>FDF-MOC Interface Control Document</i> .	This includes both definitive and predictive orbit products.	GSRD	MOC4620
ORB0050	The MOC shall integrate orbit sequential print files into the Flight Dynamics System.	GPS data	GSRD	MOC4620
ORB0060	The Flight Dynamics System shall generate orbital predictions.		GSRD	MOC4600
ORB0070	The Flight Dynamics System shall use the J2000 Earth Centered Inertial (ECI) coordinate system.		GSRD	SYS0190
ORB0080	The MOC shall receive NORAD Two Line Elements (TLEs).		GSRD	MOC4600
ORB0090	The MOC shall integrate TLEs in the Flight Dynamics System.		GSRD	MOC4600
ORB0100	The Flight Dynamics System shall generate IIRVs for TDRSS scheduling		Derived	
ORB0110	The MOC shall retain orbit solutions for the duration of the mission.		GSRD	MOC4660
ORB0120	The MOC shall allow viewing of orbit solutions.		GSRD	MOC4660
ORB0130	The MOC shall allow updating of orbit solutions.		GSRD	MOC4660

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Req ID	Requirement	Comments	Source	Source ID
Flight Dynamics Requirements				
ORB0140	The MOC shall perform orbit propagation.		GSRD	MOC4600, MOC4630
ORB0150	The MOC shall perform orbit propagation with a minimum accuracy of 1 second for a 3-day prediction for Absolute Time Commands.		GSRD	MOC4640
ORB0160	The MOC shall perform orbit propagation with a minimum accuracy of 1 second for a 3-day prediction for event-based predictions.		Derived	
ORB0170	The MOC shall perform orbit propagation with a minimum accuracy of 0.1 degrees for a 3-day prediction for angle-based predictions.		Derived	
ORB0180	The MOC shall generate orbital products using propagated orbit solutions as specified in the <i>GLAST Operations Data Products ICD</i> .		GSRD	MOC4600
ORB0190	The Flight Dynamics System shall generate event reports for the MPS.		Derived	
ORB0200	The MOC shall use the Science Activity Timeline to predict the observatory attitude.	Attitude dependant scheduling due to the pointing limitations of the Ku-band antenna	Derived	
ORB0210	The Flight Dynamics System shall generate predicted ground station and TDRS view periods for the S-band antennas.		GSRD	MOC4600
ORB0220	The Flight Dynamics System shall generate predicted TDRS view periods for the Ku-band antenna.		GSRD	MOC4600
ORB0230	The MOC shall generate spacecraft day/night predictions, including umbra and penumbra event times.		GSRD	MOC4600

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Req ID	Requirement	Comments	Source	Source ID
Flight Dynamics Requirements				
ORB0240	The MOC shall generate predicted South Atlantic Anomaly (SAA) region entry and exit times for both the GBM and LAT instruments.		GSRD	MOC4600
ORB0250	The MOC shall generate predicted ephemeris data for GLAST.		GSRD	MOC4600
ORB0260	The MOC shall generate predicted ephemeris data for TDRS satellites.		GSRD	MOC4600
ORB0270	The MOC shall generate definitive ephemeris data for GLAST.		GSRD	MOC4600
ORB0280	The MOC shall model ground antenna masking constraints to determine access times.		GSRD	MOC4600
ORB0290	The MOC shall model observatory antenna masking constraints to determine access times.		GSRD	MOC4600
ORB0300	The MOC shall model sun-line RF interference.		GSRD	MOC4600

3.2.2. TDRSS Scheduling

Req ID	Requirement	Comments	Source	Source ID
TDRSS Scheduling Requirements				
TSH0010	The MOC shall schedule all SN/TDRSS contacts with the observatory for command uplink and telemetry downlink.		GSRD	SYS0050, MOC0010, MOC4000, MOC4020
TSH0020	The MOC shall use RA and DEC as the standard means of communicating pointing directions to the space network.		GSRD	SYS0200

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Req ID	Requirement	Comments	Source	Source ID
TDRSS Scheduling Requirements				
TSH0030	The MOC shall schedule TDRSS/DAS services via the SWSI for continuous 24x7 service.		GSRD	MOC4900
TSH0040	The MOC shall schedule WDISC MA services via the SWSI.		GSRD	MOC4900
TSH0050	The MOC shall schedule WDISC SSA services via the SWSI.		GSRD	MOC4900
TSH0060	The MOC shall schedule Ku-band services via the SWSI.		GSRD	MOC4900
TSH0070	The MOC shall obtain the TDRSS Forecast Schedule.		Derived	
TSH0080	The MOC shall obtain SN/TDRSS service availability times from WSC in the TDRSS Unscheduled Time (TUT) report.	For scheduling WDISC MA and SSA services	Derived	
TSH0090	The MOC shall receive the TUT report via the SWSI.		Derived	
TSH0100	The MOC shall determine the times when the observatory has access to the SN.		GSRD	MOC4600
TSH0110	The MOC shall model the predicted observatory attitude when in sky survey mode to determine SN access times.		GSRD	MOC4600
TSH0120	The MOC shall model the predicted observatory attitude when in a pointed observation mode to determine SN access times.		GSRD	MOC4600
TSH0130	The MOC shall temporally model transitions into, out of, and between the observatory science gathering modes.		GSRD	MOC4600

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Req ID	Requirement	Comments	Source	Source ID
TDRSS Scheduling Requirements				
TSH0140	The MOC shall account for science gathering mode transitions when determining TDRSS access times.		GSRD	MOC4600
TSH0150	The MOC shall temporally model the GLAST generic steering algorithm used for steering through a constraint with a limited slew rate.	This algorithm is used when the path of the body z-axis passes close to the sun vector to compensate for the limited yaw slew rate of the observatory.	GSRD	MOC4600
TSH0160	The MOC shall account for yaw steering when determining TDRSS access times.		GSRD	MOC4600
TSH0170	The MOC shall temporally model the GLAST generic steering algorithm used for constraint avoidance.	This algorithm is used when the path of the body z-axis passes close to the negative of the position vector to allow for earth limb tracing.	GSRD	MOC4600
TSH0180	The MOC shall account for earth limb traces when determining TDRSS access times.		GSRD	MOC4600
TSH0190	The MOC shall model the predicted ephemeris to determine SN access times.		GSRD	MOC4600
TSH0200	The MOC shall send TDRSS schedule requests to the WSC via SWSI.		Derived	
TSH0210	The MOC shall receive SN/TDRSS schedule and system status data via the SWSI system.		Derived	
TSH0220	The MOC shall receive electronic notification from the SN of any pending changes to the TDRSS schedule at least 12 hours prior to the change.		GSRD	MOC4030

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Req ID	Requirement	Comments	Source	Source ID
TDRSS Scheduling Requirements				
TSH0230	The MOC shall provide observatory orbit information to the SN for contact acquisition.		GSRD	MOC4910
TSH0240	The MOC shall provide the orbital elements in the form of improved interranging vectors (IIRVs) to WSC via SWSI for TDRSS contact acquisition generation.		GSRD	SYS0050,
TSH0250	The MOC shall have the capability to send Ground Communications Message Requests (GCMRs) to the WSC for requesting SN configuration changes via the SWSI system.		Derived	
TSH0260	The MOC shall provide the capability to schedule two TDRSS One-way Doppler services to support orbit determination.	FDF will use the One-way Doppler products to perform DOWD predictions.	Derived	

3.2.3. Backup Ground Network Scheduling

Req ID	Requirement	Comments	Source	Source ID
Backup Ground Network Scheduling Requirements				
GND0010	The MOC shall schedule all backup ground station contacts with the observatory for command uplink and telemetry downlink.		GSRD	MOC0010, MOC4000, MOC4020, MOC4800
GND0020	The MOC shall model the predicted ephemeris to determine backup ground station access times.		Derived	
GND0030	The MOC shall provide orbital elements to the backup ground stations for contact acquisition.		GSRD	MOC4810

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Req ID	Requirement	Comments	Source	Source ID
Backup Ground Network Scheduling Requirements				
GND0040	The MOC shall receive ground station contact schedules from the backup ground stations.		Derived	

3.2.4. Target of Opportunity

Req ID	Requirement	Comments	Source	Source ID
Target Of Opportunity Requirements				
TOO0010	The MOC shall be capable of retrieving Target of Opportunity (ToO) observation orders from the GSSC.		GSRD	MOC4400
TOO0020	The MOC shall retain a copy of all ToO orders received from the GSSC.		GSRD	MOC4070
TOO0030	The MOC shall be capable of ensuring Target of Opportunity (ToO) observation orders do not violate observatory constraints.		GSRD	SYS1020
TOO0040	The MOC shall be capable of generating ToO commands.	Commanding	GSRD	SYS1020
TOO0050	The MOC shall be capable of scheduling TDRSS forward link service to uplink ToO commands within 30 minutes.	Scheduling	GSRD	SYS1020
TOO0060	The MOC shall be capable of transmitting ToO commands.	Commanding	GSRD	SYS1020
TOO0070	The MOC shall be capable of implementing all approved ToOs that satisfy observatory constraints.	Depending on SWG for resolution.	GSRD	SYS1020

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Req ID	Requirement	Comments	Source	Source ID
Target Of Opportunity Requirements				
TOO0080	The MOC system shall provide the capability to generate ToO commands, schedule TDRSS forward link service, and transmit the commands within 4 hours of receipt of the ToO order from the GSSC.	Does not include the time required by the GSSC for ToO handling. It does include the time to make the SN forward link service available, which means the MOC must give the SN at least 30 minutes to provide the service (see associated SN TOO requirement). Latency applies only if no problems are encountered that require operator intervention. Otherwise the ToO will be handled on a best effort basis.	GSRD	MOC4430, SYS0160
TOO0090	The MOC shall implement at least 95% of approved ToOs within the allocated latency.		GSRD	SYS1020
TOO0100	The MOC shall send the GSSC a message that specifies the disposition of the ToO order.		GSRD	MOC4420
TOO0110	The MOC shall provide the capability to confirm the execution of a ToO order.		Derived	
TOO0120	The MOC shall retain a log of ToO orders.		GSRD	MOC4440
TOO0130	The ToO log shall contain an entry for each ToO order.		GSRD	MOC4440
TOO0140	The ToO log shall contain the disposition of each ToO order.		GSRD	MOC4440
TOO0150	The MOC shall maintain the log for the duration of the mission.		GSRD	MOC4440
TOO0160	The MOC shall allow the ToO log entries to be viewed.		GSRD	MOC4440
TOO0170	The MOC shall allow the dispositions of the ToO log entries to be updated.		GSRD	MOC4440

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Req ID	Requirement	Comments	Source	Source ID
Target Of Opportunity Requirements				
TOO0180	The MOC shall allow the ToO log entries to be created.		GSRD	MOC4440

3.2.5. Stored Command Load Generation

Req ID	Requirement	Comments	Source	Source ID
Stored Command Load Generation Requirements				
LGEN0010	The MOC Mission Planning System (MPS) shall provide mission planning and scheduling functions for the observatory.		GSRD	MOC0010
LGEN0020	The MOC MPS shall use UTC time for planning and generation of commands.		GSRD	SYS0040, MOC4210
LGEN0030	The MOC shall have the command capability to reorient the observatory to within the pointing envelope of the sky survey mode for downlink transmissions of science data.		GSRD	SYS0210
LGEN0040	The MOC shall uplink orbit ephemeris data to the observatory.	This capability is needed if the onboard GPS system is not functioning properly and also immediately following launch vehicle separation.	GSRD	MOC4670
Activities				
LGEN0050	The MOC MPS shall provide the capability to create Activities.	An activity is a relative-time-stamped list of commands and activities. An activity enables a sequence of commands to be reused.	Derived	

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Req ID	Requirement	Comments	Source	Source ID
Stored Command Load Generation Requirements				
LGEM0060	The MOC MPS shall provide the capability to edit Activities.		Derived	
LGEM0070	The MOC MPS shall provide the capability to print Activities.		Derived	
LGEM0080	The MOC MPS shall provide the capability to create Activities.		Derived	
LGEM0090	The MOC MPS shall provide the capability to delete Activities.			
LGEM0100	Each Activity shall include a user-defined name.		Derived	
LGEM0110	Each Activity shall include 1 to 255 Activities/commands with corresponding absolute or relative times.		Derived	
LGEM0120	Each Activity shall include 0 or more Activity parameters.	Activity parameters enable the sub-mnemonics values of commands in the activity to be specified when the activity is referenced rather than when the activity is defined	Derived	
LGEM0130	Each Activity shall be designated as either an Absolute Time Sequence (ATS) or a Relative Time Sequence (RTS).		Derived	
LGEM0140	Each Activity shall include a textual remark.		Derived	
LGEM0150	The MOC MPS shall allow the user to enter commands into an Activity.		Derived	
LGEM0160	The MOC MPS shall allow the user to enter references to other Activities into an Activity.		Derived	

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Req ID	Requirement	Comments	Source	Source ID
Stored Command Load Generation Requirements				
LGEN0170	The MOC MPS shall allow the user to enter relative time intervals between each command and Activity.		Derived	
LGEN0180	The MOC MPS shall allow the user to enter command submnemonic values in decimal format.		Derived	
LGEN0190	The MOC MPS shall allow the user to enter command submnemonic values in hexadecimal format.		Derived	
LGEN0200	The MOC MPS shall allow the user to enter command submnemonic values in octal format.		Derived	
LGEN0210	The MOC MPS shall allow the user to enter command submnemonic values in binary format.		Derived	
LGEN0220	The MOC MPS shall allow the user to enter command submnemonic values as EU converted values.		Derived	
LGEN0230	The MOC MPS shall allow the user to enter command submnemonic values as raw values.		Derived	
LGEN0240	The MOC MPS shall provide the capability to ingest the command database.		Derived	
LGEN0250	The MOC MPS shall ensure that all commands entered are in the commands database.		Derived	
LGEN0260	The MOC MPS shall ensure that each command entered includes all appropriate submnemonic values.		Derived	

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Req ID	Requirement	Comments	Source	Source ID
Stored Command Load Generation Requirements				
LGGEN0270	The MOC MPS shall prevent the user from entering command submnemonic values that are outside of the range defined in the command database.		Derived	
Triggers				
LGGEN0280	The MOC MPS shall provide the capability to create triggers.	A trigger contains automatic scheduling criteria along with a list of relative-time-stamped commands and activities that are to be scheduling when the criteria is true.	Derived	
LGGEN0290	The MOC MPS shall provide the capability to edit triggers.		Derived	
LGGEN0300	The MOC MPS shall provide the capability to print triggers.		Derived	
LGGEN0310	The MOC MPS shall provide the capability to delete triggers.		Derived	
LGGEN0320	The MOC MPS shall allow the user to associate Activities and commands with triggers.		Derived	
LGGEN0330	The MOC MPS shall enable the user to specify 1 to 100 conditional tests for each trigger.		Derived	
LGGEN0340	The MOC MPS shall provide the capability to activate a trigger at a user-defined UTC.		Derived	
LGGEN0350	The MOC MPS shall provide the capability to activate a trigger at a time that is defined relative to an event time.		Derived	
LGGEN0360	The MOC MPS shall allow triggers to activate relative to scheduled TDRSS pass times.		Derived	
LGGEN0370	The MOC MPS shall allow triggers to activate relative to scheduled ground station pass times.		Derived	

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Req ID	Requirement	Comments	Source	Source ID
Stored Command Load Generation Requirements				
LGEN0380	The MOC MPS shall allow triggers to activate relative to penumbra times.		Derived	
LGEN0390	The MOC MPS shall allow triggers to activate relative to umbra times.		Derived	
LGEN0400	The MOC MPS shall allow triggers to activate relative to South Atlantic Anomaly (SAA) crossing times.		Derived	
LGEN0410	The MOC MPS shall allow triggers to activate relative to apogee crossing times.		Derived	
LGEN0420	The MOC MPS shall allow triggers to activate relative to perigee crossing times.		Derived	
LGEN0430	The MOC MPS shall allow triggers to activate relative to ascending node crossing times.		Derived	
LGEN0440	The MOC MPS shall allow triggers to activate relative to descending node crossing times.		Derived	
Activity Plan Periods				
LGEN0450	The MOC MPS shall allow the user to create Activity Plan Periods.	The activity plan period is the duration of the ATS load.	Derived	
LGEN0460	The MOC MPS shall allow the user to define the time range for an Activity Plan Period.		Derived	
LGEN0470	The MOC MPS shall allow the user to populate the Activity Plan Periods by manually adding commands/Activities.		Derived	
LGEN0480	The MOC MPS shall require the user to supply an absolute time for each command/Activity manually added to an Activity Planning Period.		Derived	

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Req ID	Requirement	Comments	Source	Source ID
Stored Command Load Generation Requirements				
LGEM0490	The MOC MPS shall allow the user to enter only those activity definitions that are currently defined in the activity dictionary into an Activity Plan Period.		Derived	
LGEM0500	The MOC MPS shall allow the user to populate the Activity Plan Periods using Triggers.		Derived	
RTS Tables				
LGEM0510	The MOC MPS shall allow the user to create RTS Tables.		Derived	
LGEM0520	The RTS Tables shall be created from Activities.		Derived	
LGEM0530	The MOC MPS shall allow the user to enter only those activity definitions that are currently defined in the activity dictionary into an RTS Table.		Derived	
Command Load Generation				
LGEM0540	The MOC MPS shall allow the user to select the external input files that determine actual event times.		Derived	
LGEM0550	The MOC MPS shall ingest and integrate the ground station contact schedules into the stored command load generation function.		GSRD	MOC4270
LGEM0560	The MOC MPS shall ingest and integrate the TDRSS contact schedules into the stored command load generation function.		GSRD	MOC4280
LGEM0570	The MOC MPS shall integrate event reports from the Flight Dynamics System into the stored command load generation function.		Derived	

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Req ID	Requirement	Comments	Source	Source ID
Stored Command Load Generation Requirements				
LGEN0580	The MOC shall integrate the FDF orbit products into the stored command load generation function.		GSRD	MOC4620
LGEN0590	The MOC shall ingest and integrate the science timelines created by the GSSC into the stored command load generation function.	These timelines are sequences of onboard activities.	GSRD	SYS0050, SYS0220, MOC4230
LGEN0600	The MOC shall retain a copy of all instrument loads and commands received from the GSSC and IOCs.		GSRD	MOC4070
LGEN0610	The MOC MPS shall include the Activities/commands associated with the trigger into the Activity Plan Period only if all condition test for that trigger results in a value of TRUE.		Derived	
LGEN0620	The MOC MPS shall automatically supply an absolute time for each command and Activity added to an Activity Plan Period using a trigger.		Derived	
LGEN0630	The MOC MPS shall allow the user to modify the absolute time of each command and Activity within an Activity Plan Period.		Derived	
LGEN0640	The MOC MPS shall allow the user to delete commands and Activities from the Activity Plan Period.		Derived	
LGEN0650	The MOC MPS shall provide the ability to purge all Activity Plan Periods whose stop time proceeds the user-specified file retention time.		Derived	
LGEN0660	The MOC MPS shall display the Activity Plan Period's start and stop times.		Derived	

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Req ID	Requirement	Comments	Source	Source ID
Stored Command Load Generation Requirements				
LGEN0670	For each ATS Activity Plan Period, the MOC MPS shall produce Absolute Time Sequence (ATS) commands.		GSRD	MOC0010, MOC4000, MOC5440
LGEN0680	The MOC MPS shall allow for overlapping ATS loads.		Derived	
LGEN0690	The MOC shall produce ATS loads that correlate with the Integrated Observatory Timeline		GSRD	MOC4220
LGEN0700	The MOC MPS shall allow zero or more alternate loads in any Activity Plan Period.		GSRD	MOC4000
LGEN0710	The MOC MPS shall include the Activities/commands associated with the trigger into the RTS Table only if all of the conditional tests for that trigger results in a value of TRUE.		Derived	
LGEN0720	The MOC MPS shall automatically supply a relative time for each command and Activity added to a RTS Table using a trigger		Derived	
LGEN0730	The MOC MPS shall allow the user to modify the relative time of each command and Activity within a RTS Table.		Derived	
LGEN0740	The MOC MPS shall allow the user to delete commands and Activities from the RTS Table.		Derived	
LGEN0750	For each RTS Table, the MOC MPS shall produce Relative Time Sequence (RTS) commands.		GSRD	MOC0010, MOC4000, MOC5440
LGEN0760	Command loads shall span up to 10 days but may be uplinked 1 or more times a week.		GSRD	MOC4000

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Req ID	Requirement	Comments	Source	Source ID
Stored Command Load Generation Requirements				
LGEN0770	The MOC MPS shall allow the user to delete a load.		GSRD	MOC4000
LGEN0780	The MOC MPS shall display the selected load's destination, the number of ATS commands contained in the load, and the size of the load in bytes.		GSRD	MOC4000
LGEN0790	The MOC MPS shall maintain the status of all MPS generated ATS and RTS loads.		GSRD	MOC4000
LGEN0800	The status of ATS and RTS loads shall include load file generation time, valid uplink window, and uplink status.		Derived	
LGEN0810	The MOC MPS shall provide the capability to create reports on the status of all ATS and RTS loads.		Derived	
LGEN0820	The MOC MPS shall indicate if the selected load contains uncorrected errors, contains manual edits, has been generated, has been transferred, and has been uplinked.		Derived	
Constraint Definitions				
LGEN0830	The MOC MPS shall provide the capability to define at least two types of constraints known as Error Constraints and Warning Constraints.		GSRD	MOC4010
LGEN0840	Upon encountering an Error Constraint, the MOC MPS shall notify the operator and prohibit the creation of load files.		GSRD	MOC4010
LGEN0850	Upon encountering a Warning Constraint, the MOC MPS shall notify the operator.		GSRD	MOC4010

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Req ID	Requirement	Comments	Source	Source ID
Stored Command Load Generation Requirements				
LGEN0860	The MOC MPS shall schedule all S/C and instrument engineering events within the constraints of the S/C and instruments.	This applies to non-science related activities needed for observatory HK.	GSRD	MOC4010
LGEN0870	The MOC MPS shall verify all command loads against constraints prior to uplink to the S/C		GSRD	MOC4300
LGEN0880	The MOC MPS shall provide the capability to manually create constraint definitions.		GSRD	MOC4290
LGEN0890	The MOC MPS shall provide the capability to manually edit constraint definitions.		GSRD	MOC4290
LGEN0900	The MOC MPS shall provide the capability to manually print constraint definitions.		GSRD	MOC4290
LGEN0910	The MOC MPS shall provide the capability to manually delete constraint definitions.		GSRD	MOC4290
LGEN0920	The MOC MPS shall provide constraint definitions that ensure command sequence dependencies.	If command A is present in a load, then command C cannot appear in the load until after command B.	GSRD	MOC4010
LGEN0930	The MOC MPS shall provide constraint definitions that ensure command timing dependencies:	If command A is present in the load, then command B must appear no sooner than the relative time C, and no later than the relative time D.	GSRD	MOC4010
LGEN0940	The MOC MPS shall provide constraint definitions that ensure command time delay:	If command A is present in the load, then command B cannot exist in the load any sooner than the relative time C.	GSRD	MOC4010
LGEN0950	The MOC shall permit no more than 8 commands in any given second within an ATS or an RTS.		Derived	
Load Files				

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Req ID	Requirement	Comments	Source	Source ID
Stored Command Load Generation Requirements				
LGEN0960	The MOC MPS shall create a load file from an ATS.		GSRD	MOC4000
LGEN0970	The MOC MPS shall create a load file from a RTS.		GSRD	MOC4000
LGEN0980	The MOC MPS shall be capable of generating ATS load files within 2 hours.		GSRD	MOC5440
LGEN0990	The MOC MPS shall be capable of generating RTS load files within 2 hours.		GSRD	MOC5440
LGEN1000	The load files shall be compatible with the MOC Telemetry & Command (T&C) system load file format.		Derived	
LGEN1010	The MOC MPS shall automatically transfer any generated ATS and RTS load files to the primary T&C system after generation and validation.		GSRD	MOC4000
Integrated Observatory Timeline				
LGEN1020	The MOC MPS shall generate an Integrated Observatory Timeline as defined in the Operations Data Products ICD.		GSRD	MOC4200, MOC4000
LGEN1030	An Integrated Observatory Timeline shall be based on a selected Activity Plan Period.		GSRD	MOC4200, MOC4000
LGEN1040	The Integrated Observatory Timeline shall contain an absolute time tagged list of planned activities/events.		GSRD	MOC4200, MOC4000
LGEN1050	The MOC shall re-plan the Integrated Observatory Timeline within 2 hours.		GSRD	MOC9110

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Req ID	Requirement	Comments	Source	Source ID
Stored Command Load Generation Requirements				
LGEN1060	The MOC shall make the Integrated Observatory Timeline available to the GSSC and the IOCs.		GSRD	MOC4240

3.3. Telemetry & Command Processing

3.3.1. Telemetry Processing

Req ID	Requirement	Comments	Source	Source ID
Telemetry Processing Requirements				
Data Ingest				
TLM0010	The MOC T&C system shall receive CCSDS transfer frames using the IP network protocol.		Derived	
TLM0020	The MOC shall ingest all CCSDS transfer frames received.		GSRD	MOC5010
TLM0030	The MOC T&C system shall be able to independently configure and control two spacecraft telemetry streams.		Derived	
TLM0040	The MOC shall receive telemetry data from the observatory via the SN and backup ground stations.		GSRD	MOC5000
TLM0050	The MOC T&C system shall be able to automatically form IP socket connections with the SN and backup ground stations.		GSRD	MOC9000
TLM0060	The MOC T&C system shall recognize broken socket connections and automatically attempt reconnection.	For connections in which the MOC is the client.	GSRD	MOC9000

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Req ID	Requirement	Comments	Source	Source ID
Telemetry Processing Requirements				
TLM0070	The MOC shall receive RT HK telemetry from the backup ground stations at a maximum rate of 51 kbps.		GSRD	SYS2020, MOC5020
TLM0080	The MOC shall receive RT HK telemetry from TDRSS at a maximum rate of 51 kbps.		GSRD	SYS2020, MOC5030
TLM0090	The MOC shall be capable of receiving RT telemetry at a rate up to 152 kbps.	This includes HK and diag data.	GSRD	SYS2020
TLM0100	The MOC shall receive observatory event and telecommand logs.	This will allow the FOT to view interpreted log reports for troubleshooting.	GSRD	MOC5090
TLM0110	The MOC shall receive S/C and instrument on-board processor memory dump and table dump data.	Provided to S/C vendor and the IOC's for further processing	GSRD	MOC5080
TLM0120	The MOC shall receive recorded observatory HK and science data post pass.	Science data will only come from the SN.	GSRD	MOC5070
TLM0130	The MOC T&C system shall receive recorded observatory HK and science data sorted by Virtual Channel.		Derived	
TLM0140	The MOC T&C system shall receive recorded observatory HK and science data via FTP.		Derived	
TLM0150	The MOC shall be able to capture a dump of at least 30 hours of recorded science and 36 hours of recorded housekeeping data.	This ensures the Ground System can handle the largest size data dump from the observatory. The data is assumed to be continuously collected at orbit averaged rates.	GSRD	SYS2010
TLM0160	The MOC T&C system shall report data not received in the required time as event messages.		GSRD	MOC2020, MOC5000, MOC5350, MOC9065

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Req ID	Requirement	Comments	Source	Source ID
Telemetry Processing Requirements				
TLM0170	The MOC shall send requests for retransmission of observatory data to the ground stations.		GSRD	MOC1540
TLM0180	The MOC shall send requests for retransmission of observatory data to WSC.		Derived	
Data Processing				
TLM0190	The MOC shall process all telemetry received from the observatory.	Processing includes providing data extraction, state conversions and Engineering Unit (EU) conversions.	GSRD	SYS0070, MOC0010, MOC5000
TLM0200	The MOC shall automatically process recorded observatory HK data when received from the ground stations and SN.		GSRD	MOC6010, MOC9000
TLM0210	The MOC shall process observatory telemetry that is compliant with the Consultative Committee for Space Data Systems (CCSDS) Packet Telemetry Recommendations as defined in the Series 100 Blue Books.		GSRD	SYS0020, MOC0060
TLM0220	The MOC shall process RT telemetry from TDRSS at a maximum rate of 152 kbps.		GSRD	MOC5030
TLM0230	The MOC T&C system shall process RT telemetry from the ground station at a rate of 152 kbps.		Derived	
TLM0240	The MOC T&C system shall provide the capability to display hexadecimal dumps of CCSDS transfer frames and packets.		Derived	
TLM0250	The MOC T&C system shall provide the capability to save hexadecimal dumps of CCSDS transfer frames and packets.		Derived	

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Req ID	Requirement	Comments	Source	Source ID
Telemetry Processing Requirements				
TLM0260	The MOC T&C system shall provide the capability to print hexadecimal dumps of CCSDS transfer frames and packets.		Derived	
TLM0270	The MOC shall be able to process a dump of at least 30 hours of recorded science and 36 hours of recorded housekeeping data.	This ensures the Ground System can handle the largest size data dump from the observatory. The data is assumed to be continuously collected at orbit averaged rates.	GSRD	SYS2010
TLM0280	The MOC T&C system shall process observatory event and telecommand logs.	This will allow the FOT to view interpreted log reports for troubleshooting.	GSRD	MOC5090
TLM0290	The MOC shall record and trend the TDRSS link frequency measurement data from the SN via the DAS system at 1-minute intervals.	Support link margin analysis	Derived	
TLM0300	The MOC shall process recorded housekeeping data at up to twice the real-time rate.	This provides the ability to replay previously recorded data through the real-time system.	GSRD	MOC6050
TLM0310	The MOC shall process retransmitted data within 24 hours of its arrival.	This is data resulting from a retransmission request sent by the MOC	GSRD	MOC2130
TLM0320	The MOC T&C system shall process S/C and instrument on-board processor memory dump and table dump data.	Provided to S/C vendor and the IOC's for further processing. This requirement applies to both RT and recorded data.	GSRD	MOC5080
TLM0330	Each table dump shall be stored as a separate image file.		Derived	
TLM0340	The MOC T&C system shall distinguish between test HK data and operational HK data.	Dependent upon having appropriate flags set in the data.	GSRD	MOC2050

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Req ID	Requirement	Comments	Source	Source ID
Telemetry Processing Requirements				
TLM0350	The MOC T&C system shall provide the capability to select a new telemetry data source and reinitialize the status and accounting parameters within 20 seconds of the request.	This includes resetting the Current Value Table (CVT) and purging all previously received telemetry data.	Derived	
TLM0360	The MOC shall contribute a data loss of no more than 1%.	The total allocation for the ground system is 1.9%.	GSRD	SYS1040, MOC1010
Data Extraction				
TLM0370	The MOC T&C system shall extract CGS header information.		Derived	
TLM0380	The MOC T&C system shall extract frame sequence errors based on the transfer frame header.		Derived	
TLM0390	The MOC T&C system shall extract the observatory frame timestamp from the secondary header of the transfer frame.		Derived	
TLM0400	The MOC T&C system shall extract CCSDS packet telemetry from the transfer frame data.		Derived	
TLM0410	The MOC T&C system shall extract CLCW information.		Derived	
TLM0420	The MOC T&C system shall extract source packet information.		Derived	
TLM0430	The MOC T&C system shall extract table and memory dump image information.		Derived	
TLM0440	The MOC T&C system shall extract all data types as specified in the <i>GLAST-MOC ICD</i> and <i>GLAST T&C Handbook</i> .		GSRD	MOC5130
TLM0450	The MOC shall extract parameter data from the observatory HK packets.		GSRD	MOC5130

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Req ID	Requirement	Comments	Source	Source ID
Telemetry Processing Requirements				
TLM0460	The MOC T&C system shall store the latest extracted raw values of telemetry mnemonics in the system and make these raw values available to all GDS elements.		Derived	
Data Quality & Stats				
TLM0470	The MOC shall monitor telemetry data from the GLAST observatory.		GSRD	MOC5000
TLM0480	The MOC shall identify questionable quality data based on information received from the ground stations and the SN.		GSRD	MOC5000, MOC5100
TLM0490	The MOC T&C system shall perform data quality-checking and annotation.		Derived	
TLM0500	The MOC T&C system shall be capable of checking the CRC on TDRSS transfer frames and set the quality flag in the resulting MOC T&C system annotated packet header.		Derived	
TLM0510	The MOC T&C system shall record the quality and completeness of the all telemetry received for the duration of the mission		GSRD	MOC2040
TLM0520	The MOC T&C system shall provide transfer frame processing statistics on each VC and on the aggregate.		GSRD	MOC5110
TLM0530	Processing statistics shall include the total number of frames received.		GSRD	MOC5110
TLM0540	Processing statistics shall include the total number of good frames received.		GSRD	MOC5110
TLM0550	Processing statistics shall include the total number of sequence errors.		GSRD	MOC5110

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Req ID	Requirement	Comments	Source	Source ID
Telemetry Processing Requirements				
TLM0560	Processing statistics shall include the total number of Reed-Solomon decoding errors.		GSRD	MOC5110
TLM0570	The MOC T&C system shall automatically monitor the delivery of telemetry data to ensure that the data is received in the required time.		GSRD	MOC2020, MOC9000
TLM0580	The MOC T&C system shall automatically assess the quality of each file received from the SN.		GSRD	MOC2030, MOC9000
TLM0590	The MOC T&C system shall automatically assess the quality of each file received from the backup ground stations.		GSRD	MOC9000
TLM0600	The MOC T&C system shall record data quality problems requiring operator intervention as event messages.		GSRD	MOC2030, MOC5350
TLM0610	The MOC T&C system shall record Reed-Solomon frame decoding corrections as event messages indicating that a sequence error has occurred.	No more than one sequence error or Reed-Solomon correction event message should occur every 5 seconds.	GSRD	MOC5350
TLM0620	The MOC T&C system shall provide the capability to display the telemetry quality and completeness record.		GSRD	MOC2040
Data Value Conversion				
TLM0630	The MOC T&C system shall provide discrete state conversions as specified in the T&C database.		GSRD	MOC5130

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Req ID	Requirement	Comments	Source	Source ID
Telemetry Processing Requirements				
TLM0640	The MOC T&C system shall provide conversion from downlinked raw values to Engineering Units (EUs), as identified in the T&C database and GLAST T&C Handbook.		GSRD	MOC5130
TLM0650	The MOC T&C system shall provide the capability to temporarily change EU conversions from the value specified in the T&C database.		GSRD	MOC5130
Data Transfer				
TLM0660	The MOC shall provide the capability to transmit real-time housekeeping data to the LISOC.		GSRD	MOC2110
TLM0670	The MOC shall provide the capability to enable and disable the real-time housekeeping data to the LISOC.	This is intended to be configurable in the MOC so that the real-time link to the LISOC is brought up only when needed.	GSRD	MOC2110
TLM0680	The MOC shall provide the capability to disable the real-time housekeeping data to the LISOC.		GSRD	MOC2110

3.3.2. Data Processing

Req ID	Requirement	Comments	Source	Source ID
Data Processing Requirements				
Data Processing				
DCP0010	The MOC shall perform Level 0 processing using observatory data files received from the ground stations and TDRSS.		GSRD	MOC0010, MOC2000

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Req ID	Requirement	Comments	Source	Source ID
Data Processing Requirements				
DCP0020	The MOC shall process all data received from the observatory.		GSRD	SYS0110
DCP0030	The MOC shall generate Level 0 files for each contact that contain error free, time ordered non-duplicate series of packets.	Each file may have one or multiple application identifications (APIDs). MOC will not merge dump files from multiple contacts meaning that there may be duplicate data across files.	GSRD	MOC2010. MOC2070
DCP0040	The MOC shall generate Pass-Oriented Level 0 products for each contact.		Derived	
DCP0050	The MOC shall process data with an orbit average generation rate of 1.2 Mbps for LAT, 25.5 kbps for GBM, and 51 kbps observatory housekeeping data.		GSRD	SYS2020
DCP0060	The MOC shall provide the capability to process up to 1571 individual APIDs.		Derived	
DCP0070	The MOC shall generate meta-data for each Level 0 file that describes the characteristics of the file.		GSRD	MOC2060
DCP0080	The Level 0 meta-data files shall contain summary data for the entire data set	Summary data to include: file size, time of creation, total number of APIDs, packets, packets from frames without RS enabled, packets from frames with uncorrectable RS errors, packets from frames with CRC errors, sequence errors, missing packets, incomplete packets and the earliest and latest packet times.	Derived	

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Req ID	Requirement	Comments	Source	Source ID
Data Processing Requirements				
DCP0090	The Level 0 meta-data files shall contain summary data for each APID file.	Summary data to include: APID number, file size, number of packets, RS errors, CRC errors, sequence errors, missing packets, incomplete packets, and time and sequence number of 1st packet, time and sequence number of last packet.	Derived	
DCP0100	The Level 0 meta-data files shall contain missing packet list for each APID.	Missing packet list to include: APID number, location of packet with sequence error, number of missing packets, sequence number of packet, sequence number of previous packet, packet time, previous packet time.	Derived	
DCP0110	The MOC shall distinguish between test science data and operational science data.	Dependent upon having appropriate flags set in the data.	GSRD	MOC2050
DCP0120	The MOC shall provide the ability to create Level 0 files from archived observatory data.		GSRD	MOC2080
Data Transmission				
DCP0130	The MOC shall provide recorded Level 0 data to the IOCs and GSSC.		GSRD	MOC2120
DCP0140	The MOC shall make recorded Level 0 data available for the GSSC and the IOC's to download within 4 hours of receiving the dump files from the ground station.	Applies only if no problems are encountered that require operator intervention. Otherwise the data will be posted on a best effort basis.	GSRD	MOC2070
DCP0150	The MOC shall provide the capability to generate and deliver a product availability notice to the GSSC and IOC's signifying completion of Level 0 data set production.		Derived	

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Req ID	Requirement	Comments	Source	Source ID
Data Processing Requirements				
DCP0160	The product availability notice shall include the list of product files available for retrieval		Derived	
DCP0170	The MOC shall provide the capability to generate product delivery summary status data daily by APID.		Derived	
DCP0180	The product delivery summary status shall include the count of packets delivered by APID to each Ground System element.		Derived	
DCP0190	The product delivery summary status shall include the total number of bytes delivered by APID to each Ground System element.		Derived	
DCP0200	The MOC shall accommodate requests from the LISOC to re-ingest observatory data.		Derived	
DCP0210	The MOC shall accommodate requests from the GIOC to re-ingest observatory data.		Derived	

3.3.3. Data Archiving

Req ID	Requirement	Comments	Source	Source ID
Data Archiving Requirements				
ARCH0010	The MOC shall archive all incoming frame telemetry data for the life of the mission.		GSRD	SYS0070, MOC5120
ARCH0020	The MOC shall store all CCSDS transfer frames received.		GSRD	MOC5010
ARCH0030	The MOC shall retain raw transfer frames on-line for 30 days.		Derived	

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Req ID	Requirement	Comments	Source	Source ID
Data Archiving Requirements				
ARCH0040	The MOC T&C system shall provide telemetry data archiving capability that will allow the user to archive selected data to specified files.	Allows the user to store each recorder dump to a separate file.	Derived	
ARCH0050	The MOC shall copy data products to removable physical media.		GSRD	MOC2090
ARCH0060	The MOC shall be capable of storing 130Gbits per day.	Maximum LAT, GBM, and observatory data rates * 15% CCDS overhead.	Derived	
ARCH0070	The MOC shall archive the Level 0 data files for a minimum of seven days.	This provides the capability to retransmit the files to the GSSC or IOCs as necessary.	GSRD	SYS0110, MOC2100
ARCH0080	The MOC shall allow an operator to control the storage and retrieval of data on removable physical media.		Derived	
ARCH0090	The MOC T&C system shall provide the capability to create an archive file.		Derived	
ARCH0100	The MOC T&C system shall provide the capability to display an archive file.		Derived	
ARCH0110	The MOC T&C system shall provide the capability to delete an archive file.		Derived	
ARCH0120	The MOC T&C system shall replay telemetry transfer frames based on user selection of ground receipt time, virtual channel identifier (VCID), and/or spacecraft time.		GSRD	MOC2080
ARCH0130	The MOC T&C system shall replay telemetry transfer frames.		GSRD	MOC6050
ARCH0140	The MOC T&C system shall replay telemetry transfer frames at a user selectable rate.		Derived	

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3.3.4. Alert Telemetry Monitoring

Req ID	Requirement	Comments	Source	Source ID
Alert Telemetry Monitoring Requirements				
TDRS0010	The MOC shall receive alert telemetry containing S/C and instrument alert telemetry through the SN/Demand Access System (DAS).		GSRD	MOC5260, MOC5060 MOC5250
TDRS0020	The MOC shall receive alert telemetry containing S/C and instrument alert telemetry through the scheduled backup ground station contacts.		Derived	MOC5060
TDRS0030	The MOC shall receive alert telemetry containing S/C and instrument alert telemetry through the scheduled TDRSS contacts.		Derived	MOC5060
TDRS0040	The MOC shall transmit burst telemetry to the GIOC.		GSRD	MOC8100
TDRS0050	The MOC shall transmit burst telemetry to the Burst Alert Processor (BAP)		GSRD	MOC8100
TDRS0060	The MOC shall page the appropriate personnel if the MOC cannot successfully send burst telemetry to the BAP.		Derived	
TDRS0070	The MOC shall page the appropriate personnel if the MOC cannot successfully send burst telemetry to the GIOC.		Derived	
TDRS0080	The MOC shall transmit burst alerts to the BAP within 0.5 seconds of their receipt.	Performance measured from receipt at the MOC to initiation of the transfer.	GSRD	SYS0130, MOC8110
TDRS0090	The MOC shall transmit burst alerts to the GIOC.	A best effort will be used to achieve a near real-time latency.	GSRD	MOC8112
TDRS0100	The MOC T&C system shall report alert telemetry as event messages.		GSRD	MOC5350, MOC8000, MOC9065

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Req ID	Requirement	Comments	Source	Source ID
Alert Telemetry Monitoring Requirements				
TDRS0110	The MOC shall archive all messages received via the SN/DAS for the duration of the mission.		Derived	
TDRS0120	The MOC T&C system shall send TDRSS alert message log files to the MOC Anomaly Tracking and Notification System.		Derived	
TDRS0130	The MOC T&C system shall receive alert telemetry and send alert telemetry log files to the MOC Anomaly Tracking and Notification System when the MOC is not staffed.		GSRD	MOC8010

3.3.5. User Interface Language

Req ID	Requirement	Comments	Source	Source ID
User Interface Language Requirements				
UIL0010	The MOC T&C system shall provide a user interface language.		GSRD	MOC5490
UIL0020	The MOC T&C system user interface language shall be capable of providing system configuration control.		GSRD	MOC5490
UIL0030	The MOC T&C system user interface language shall be capable of providing telemetry monitoring.		GSRD	MOC5490
UIL0040	The MOC T&C system user interface language shall be capable of providing commanding.		GSRD	MOC5490
UIL0050	The MOC T&C system user interface language shall allow procedure parameter passing.		Derived	
UIL0060	The MOC T&C system user interface language shall provide local and global variables.		Derived	

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Req ID	Requirement	Comments	Source	Source ID
User Interface Language Requirements				
UIL0070	The MOC T&C system user interface language shall provide arithmetic capabilities using local and global variables, telemetry values, system variables, and constants.		Derived	
UIL0080	The MOC T&C system user interface language shall provide logic capabilities to allow conditional logic paths.		Derived	
UIL0090	The MOC T&C system user interface language shall provide comment capability.		Derived	
UIL0100	The MOC T&C system user interface language shall provide access to current telemetry and system values, allowing observations of values in raw or converted form.		Derived	
UIL0110	The MOC T&C system user interface language shall provide the capability to wait until an absolute time before proceeding.		Derived	
UIL0120	The MOC T&C system shall provide the capability to process user interface language directives standalone.		Derived	
UIL0130	The MOC T&C system shall provide the capability to process user interface language directives as part of a procedure.		Derived	
UIL0140	The MOC T&C system shall provide the capability to create procedures.		Derived	
UIL0150	The MOC T&C system shall provide the capability to display procedures.		Derived	
UIL0160	The MOC T&C system shall provide the capability to edit procedures.		Derived	

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Req ID	Requirement	Comments	Source	Source ID
User Interface Language Requirements				
UIL0170	The MOC T&C system shall provide the capability to delete procedures.		Derived	
UIL0180	The MOC T&C system shall provide the capability to print procedures.		Derived	
UIL0190	The MOC T&C system shall provide the capability to save procedures.		Derived	
UIL0200	The MOC T&C system shall provide the capability to execute procedures.		Derived	
UIL0210	The MOC T&C system procedure execution capability shall provide procedure control directives to allow starting, stopping, pausing, and resuming options.		Derived	
UIL0220	The MOC T&C system shall provide the capability to adjust the execution speed of procedures.		Derived	
UIL0230	The MOC T&C system shall report both the acceptance and completion of the procedures to the user.		Derived	
UIL0240	The MOC shall provide configuration control of procedures.		GSRD	MOC0440

3.3.6. Commanding

Req ID	Requirement	Comments	Source	Source ID
Commanding Requirements				
Command Formatting/Generation				

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Req ID	Requirement	Comments	Source	Source ID
Commanding Requirements				
CMD0010	The MOC T&C system shall use UTC time for generation of commands.		GSRD	SYS0040, MOC4210
CMD0020	The MOC T&C system shall generate RT commands based on a combination of the definitions in the PDB and user input.		GSRD	SYS0060, MOC0010, MOC5430
CMD0030	The MOC T&C system shall accept command requests from the user in mnemonic format through the command directive.		GSRD	MOC5430
CMD0040	The MOC T&C system shall accept all necessary command sub-mnemonic values from the user for each command in the PBD.		GSRD	MOC5430
CMD0050	The MOC T&C system shall accept command requests from the user in a raw hexadecimal command pattern in packet format.		GSRD	MOC5430
CMD0060	The MOC T&C system shall accept command requests from the user in a raw hexadecimal command pattern in transfer frame format.		GSRD	MOC5430
CMD0070	The MOC T&C system shall generate command loads in response to command requests.		GSRD	MOC5430
CMD0080	The MOC T&C system shall validate command requests.		Derived	
CMD0090	The MOC T&C system shall report invalid command requests as event messages.		GSRD	MOC5350
CMD0100	The MOC T&C system shall implement observatory commanding that is compliant with the CCSDS Telecommand recommendations as defined in the Series 200 Blue Books.		GSRD	SYS0030, MOC0070

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Req ID	Requirement	Comments	Source	Source ID
Commanding Requirements				
CMD0110	The MOC T&C system shall extract the commands from the command load and create the CCSDS telecommand packets.		Derived	
CMD0120	The MOC T&C system shall generate the telecommand transfer frame in the format as described in the <i>Observatory-Ground ICD</i> .		Derived	
CMD0130	Telecommand packets shall contain load commands.		Derived	
CMD0140	Telecommand packets shall contain RT commands.		Derived	
CMD0150	Telecommand packets shall contain CCSDS control commands.		Derived	
CMD0160	The MOC T&C system shall insert CCSDS telecommand packets into CCSDS telecommand transfer frames.	Each transfer frame contains one telecommand packet and, therefore, one command.	Derived	
Command Transmission				
CMD0170	The MOC T&C system shall provide protection against the unintentional issue of a critical command, as indicated in the PDB, by requiring the operator to explicitly allow the command to be sent.		GSRD	MOC5470
CMD0180	The MOC T&C system shall provide protection against the unintentional issue of a hazardous command, as indicated in the PDB, by requiring the operator to enter an authorization code.		Derived	

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Req ID	Requirement	Comments	Source	Source ID
Commanding Requirements				
CMD0190	The MOC shall verify all command loads against constraints prior to uplink to the S/C.		GSRD	MOC4300
CMD0200	The MOC shall send commands to the observatory		GSRD	SYS0060
CMD0210	The MOC shall send RT commands to the observatory using ground stations.		GSRD	MOC5400
CMD0220	The MOC shall send command loads to the observatory using ground stations.		GSRD	MOC5400
CMD0230	The MOC shall send software loads to the observatory using ground stations.		GSRD	MOC5400
CMD0240	The MOC shall send table loads to the observatory using ground stations.		GSRD	MOC5400
CMD0250	The MOC T&C system shall send RT commands to the observatory using SN/TDRSS.		GSRD	MOC5400
CMD0260	The MOC T&C system shall send command loads to the observatory using SN/TDRSS.		GSRD	MOC5400
CMD0270	The MOC T&C system shall send software loads to the observatory using SN/TDRSS.		GSRD	MOC5400
CMD0280	The MOC T&C system shall send table loads to the observatory using SN/TDRSS.		GSRD	MOC5400
CMD0290	The MOC shall transmit commands to the backup ground stations at an effective uplink rate of 2 kbps.		GSRD	MOC5410
CMD0300	The MOC shall be capable of transmitting commands to the SN/TDRSS at effective uplink rates of 250 bps.		GSRD	MOC5420

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Req ID	Requirement	Comments	Source	Source ID
Commanding Requirements				
CMD0310	The MOC shall be capable of transmitting commands to the SN/TDRSS at effective uplink rates of 4 kbps.		GSRD	MOC5420
CMD0320	The MOC T&C system shall allow the user to set the delay rate between commands for metering the command output		Derived	
CMD0330	The MOC T&C system shall generate event messages for every command transmission.		GSRD	MOC5350
CMD0340	The command event message shall include the UTC of command transmission.		Derived	SYS0040
CMD0350	For all transmitted hazardous commands, the MOC T&C system command event message shall include the user name and password entered.		Derived	
CMD0360	The command event message shall include the bit structure of the transfer frame in hexadecimal.		Derived	
CMD0370	The MOC shall archive all executed commands for the life of the mission.		GSRD	MOC5480
CMD0380	The MOC shall display the archive of all executed commands.		GSRD	MOC5480
Command Verification/Retransmission				
CMD0390	The MOC T&C system shall utilize the COP-1 protocol to verify correct receipt of commands on the S/C.		GSRD	MOC0080
CMD0400	The MOC T&C system shall provide the capability to bypass COP-1 commanding.		GSRD	MOC5500

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Req ID	Requirement	Comments	Source	Source ID
Commanding Requirements				
CMD0410	For TDRSS mode, the MOC T&C system shall bypass COP-1 processing.		Derived	
CMD0420	For backup ground stations mode, the MOC T&C system shall utilize the GLAST implementation of the CCSDS 128 command sliding window.		Derived	
CMD0430	The MOC T&C system shall follow the Frame Acceptance and Reporting Mechanism (FARM) type B portion of the COP-1 protocol.		Derived	
CMD0440	The MOC T&C system shall extract the CLCW from the transfer frame.		Derived	
CMD0450	The MOC T&C system shall validate the CLCW data quality.		Derived	
CMD0460	The MOC T&C system shall generate statistics on the uplink status.		Derived	
CMD0470	The MOC T&C system shall archive statistics on the uplink status.		Derived	
CMD0480	The MOC T&C system shall display statistics on the uplink status.		Derived	
CMD0490	The MOC T&C system shall extract the CLCW only if a transfer frame is free of errors.		Derived	
CMD0500	The MOC T&C system shall complete the command frame sequence verification within 1 second of receiving a valid incremented CLCW.		Derived	
CMD0510	The MOC T&C system shall allow the user to disable spacecraft command receipt verification.	In COP-1 mode but not waiting for verification (s/c still checks sequence #)	Derived	

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Req ID	Requirement	Comments	Source	Source ID
Commanding Requirements				
CMD0520	The MOC T&C system shall allow the user to enable spacecraft command receipt verification.		Derived	
CMD0530	The MOC T&C system shall allow the user to set a command verification delay.		Derived	
CMD0540	The default verification delay shall be user definable.		Derived	
CMD0550	The command verification process shall time out after the verification delay.		Derived	
CMD0560	The MOC T&C system shall determine if the lockout flag in the CLCW is set.		Derived	
CMD0570	If the lockout flag is set, the MOC T&C system shall generate an appropriate event message.		GSRD	MOC5350
CMD0580	If the lockout flag is set, the MOC T&C system shall stop the command transmission.		Derived	
CMD0590	If the lockout flag is set, the MOC T&C system shall not clear the command buffer.		Derived	
CMD0600	The MOC T&C system shall allow the user to disable command retransmission mode.		Derived	
CMD0610	The MOC T&C system shall allow the user to enable command retransmission mode.	Via COP-1	Derived	
CMD0620	If command retransmission mode is enabled, the MOC T&C system shall automatically retransmit commands whenever commands are not verified within the verification delay period.		Derived	
CMD0630	If command retransmission mode is enabled, the MOC T&C system shall transmit a command up to three times (one original transmission and two retransmissions).		Derived	

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Req ID	Requirement	Comments	Source	Source ID
Commanding Requirements				
CMD0640	The MOC T&C system shall generate an event message if the designated transfer frame is not in the command buffer.		GSRD	MOC5350
CMD0650	The MOC T&C system shall terminate the command transmission process if spacecraft command receipt verification does not occur after the user-selected number of retransmissions.		Derived	
CMD0660	The MOC T&C system shall generate an event message if the command verification does not occur after the user-selected number of retransmissions		GSRD	MOC5350
CMD0670	The MOC T&C system shall retransmit IP command packets in response to a retransmit request from the user.	Via TCP/IP	Derived	
Commanding Functions				
CMD0680	The MOC T&C system shall uplink RTS stored command loads.		GSRD	MOC5440
CMD0690	The MOC T&C system shall uplink ATS stored command loads.		GSRD	MOC5440
CMD0700	The MOC shall uplink and activate an alternative on-board ATS command load based on late schedule change requests.	Here the users (IOC's, GSSC, and MOC) have determined that the planned observations already loaded on the S/C need to be changed.	GSRD	MOC4260

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Req ID	Requirement	Comments	Source	Source ID
Commanding Requirements				
CMD0710	The MOC T&C system shall generate software memory loads for uplink to the observatory from flight software images provided by the spacecraft and instrument Flight Software (FSW) maintenance facilities.		GSRD	MOC5450
CMD0720	The MOC T&C system shall provide the capability to send commands to the observatory to enable the downlink of recorded science and engineering data.		GSRD	MOC4060
CMD0730	The MOC T&C system shall provide the capability to send commands to the observatory to disable the downlink of recorded science and engineering data.		GSRD	MOC4060
CMD0740	The MOC shall send TDRSS ephemeris information to the observatory.	This provides information to communicate with TDRSS.	GSRD	MOC4050

3.4. Monitoring & Analysis

3.4.1. Ground System Monitoring

Req ID	Requirement	Comments	Source	Source ID
Ground System Monitoring Requirements				
GMON0010	The MOC shall monitor the MOC components to determine component failures affecting real-time operations.		GSRD	MOC5600

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Req ID	Requirement	Comments	Source	Source ID
Ground System Monitoring Requirements				
GMON0020	The MOC shall report socket failures as event messages.		GSRD	MOC5350, MOC9065
GMON0030	The MOC shall receive status data from external ground system elements.	Will be limited by the availability of status information from the external systems.	GSRD	MOC5040, MOC5050
GMON0040	The MOC shall display status data from external ground system elements.		GSRD	MOC5040, MOC5050
GMON0050	The MOC shall report changes in ground system elements as event messages.	Will be limited by the availability of status information from the external systems.	GSRD	MOC5350, MOC9095
GMON0060	The MOC shall monitor interfaces to external ground system elements required for RT operations to determine their availability for support.		GSRD	MOC5040, MOC5050, MOC5610
GMON0070	The MOC shall receive User Performance Data (UPDs) via SWSI.		Derived	
GMON0080	The MOC shall monitor the external ground system elements to determine if any interfaces are not working properly.		GSRD	MOC5040, MOC5050
GMON0090	The MOC shall report external ground system element interface failures as event messages.		GSRD	MOC5040, MOC5050, MOC5350, MOC9065
GMON0100	The MOC shall monitor the MOC network firewall for security violations.		Derived	
GMON0110	The MOC shall log MOC network firewall security violations.		GSRD	MOC5350, MOC0510

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3.4.2. Display Pages

Req ID	Requirement	Comments	Source	Source ID
Display Pages Requirements				
PAG0010	The MOC T&C system shall provide the capability for the user to create display page definition files.		Derived	
PAG0020	The MOC T&C system shall provide the capability for the user to modify display page definition files.		Derived	
PAG0030	The MOC T&C system shall provide the capability for the user to save display page definition files.		Derived	
PAG0040	The MOC T&C system display pages shall provide the capability to include any processed telemetry data for all mnemonics defined in the T&C database.		GSRD	MOC5300
PAG0050	The MOC T&C system display pages shall provide the capability to display the raw value of a mnemonic.		Derived	
PAG0060	The MOC T&C system display pages shall provide the capability to display the EU conversion value of a mnemonic.		Derived	
PAG0070	The MOC T&C system display pages shall provide the capability to display the corresponding discrete state text for the value of a mnemonic.		Derived	

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Req ID	Requirement	Comments	Source	Source ID
Display Pages Requirements				
PAG0080	The MOC T&C system display pages shall provide the capability to include a text description of included mnemonics.		Derived	
PAG0090	The MOC T&C system display pages shall provide the capability to include color designations for mnemonic values.		Derived	
PAG0100	The value and state text color for the MOC T&C system display pages shall default to the colors defined in the T&C database.		Derived	
PAG0110	The MOC T&C system display pages shall provide the capability to display values in binary.		Derived	
PAG0120	The MOC T&C system display pages shall provide the capability to display values in octal.		Derived	
PAG0130	The MOC T&C system display pages shall provide the capability to display values in hexadecimal.		Derived	
PAG0140	The MOC T&C system display pages shall provide the capability to display values in floating-point.		Derived	
PAG0150	The MOC T&C system display pages shall provide the capability to display values in integer.		Derived	
PAG0160	The MOC T&C system display pages shall provide the capability to display values in ASCII.		Derived	

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Req ID	Requirement	Comments	Source	Source ID
Display Pages Requirements				
PAG0170	The MOC T&C system display pages shall provide the capability to include converted time values.		Derived	
PAG0180	The MOC T&C system display pages shall provide the capability to include quality flag for questionable quality data.		GSRD	MOC5300
PAG0190	The MOC T&C system display pages shall provide the capability to display telemetry values that are being limit-checked with red/yellow, high/low limits in the color associated with the current limit state.		GSRD	MOC5300
PAG0200	The MOC T&C system display pages shall provide the capability to include static data flags.		GSRD	MOC5300
PAG0210	The MOC T&C system display pages shall provide the capability to include mnemonic value units.		GSRD	MOC5300
PAG0220	The MOC T&C system display pages shall provide the capability to include MOC T&C system global variables.		Derived	
PAG0230	The MOC T&C system shall allow a user to display a page defined in a display page definition file.		Derived	
PAG0240	The MOC T&C system shall allow a user to set the update rate of a display page to an integral number of seconds.		Derived	
PAG0250	The MOC T&C system display pages shall have a default update rate of 4 seconds.		Derived	

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Req ID	Requirement	Comments	Source	Source ID
Display Pages Requirements				
PAG0260	The MOC T&C system display pages shall have a maximum update rate of 1 second.		Derived	
PAG0270	The MOC T&C system shall provide the capability to support at least 25 display windows per workstation.		Derived	
PAG0280	The MOC T&C system shall provide the capability to support at least 50 parameters per display page.		Derived	
PAG0290	The MOC T&C system shall provide the capability for the user to create telemetry data plot definition files.		Derived	
PAG0300	The MOC T&C system shall provide the capability for the user to modify plot definition files.		Derived	
PAG0310	The MOC T&C system shall provide the capability for the user to save plot definition files.		Derived	
PAG0320	The MOC T&C system shall provide the capability to display telemetry data plots.		GSRD	MOC5320
PAG0330	The MOC T&C system shall provide the capability to display plots on display pages.		Derived	
PAG0340	The MOC T&C system shall provide the capability to include up to five parameters (raw or EU-converted values) in each plot.		Derived	
PAG0350	The MOC T&C system plots shall display each Y-axis parameter with unique symbols and color.		Derived	

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Req ID	Requirement	Comments	Source	Source ID
Display Pages Requirements				
PAG0360	The MOC T&C system plots shall support two Y-axis scales (one on the left side of the plot and one on the right side).		Derived	
PAG0370	The MOC T&C system shall allow the user to specify the scale of each Y-axis in the plot definition file.		Derived	
PAG0380	The MOC T&C system shall provide the capability display scatter style plots.		Derived	
PAG0390	The MOC T&C system shall provide the capability display line style plots.		Derived	
PAG0400	The MOC T&C system shall allow the user to specify the plot style in the plot definition file.		Derived	
PAG0410	The MOC T&C system shall provide the capability to display a minimum of 10 plots simultaneously.		Derived	
PAG0420	The MOC T&C system shall provide the capability print telemetry snapshots of any display page.		GSRD	MOC5310
PAG0430	The MOC shall provide configuration control of display page definitions.		GSRD	MOC0440

3.4.3. Sequential Prints

Req ID	Requirement	Comments	Source	Source ID
Sequential Prints Requirements				
PRT0010	The MOC T&C system shall allow users to specify sequential print definition files.		GSRD	MOC6030

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Req ID	Requirement	Comments	Source	Source ID
Sequential Prints Requirements				
PRT0020	Sequential print definition files shall include the data points to be sampled, the EU/raw specifications, the data output, the sampling rates, and whether or not the data is quality flagged.		GSRD	MOC6030
PRT0030	The MOC T&C system shall provide the capability to include any system parameter, telemetry mnemonic, non-telemetry status value, and local or global variables as data points in sequential print files.		Derived	
PRT0040	The MOC T&C system shall provide the capability to extract the user-defined data points to generate sequential print files.		GSRD	MOC6030
PRT0050	The MOC T&C system shall support collection of at least 40 data sequential print files at one time.		Derived	
PRT0060	The MOC T&C system shall support the collection of an unlimited number of samples for each telemetry point in an active sequential print file.	Within disk space constraints.	Derived	
PRT0070	The MOC T&C system shall provide the capability to display sequential print output files.		Derived	
PRT0080	The MOC T&C system shall provide the capability to print sequential print output files.		Derived	
PRT0090	The MOC T&C system shall provide the capability to save sequential print output files.		GSRD	MOC6030

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Req ID	Requirement	Comments	Source	Source ID
Sequential Prints Requirements				
PRT0100	Sequential print output files shall be saved in ASCII file format.		GSRD	MOC6030
PRT0110	A user-specified delimiter shall separate values within sequential print output files.		Derived	
PRT0120	The MOC T&C system shall provide the capability for each sequential print output file to include an optional header with each telemetry parameter identified by a mnemonic or user-defined description.		Derived	
PRT0130	The MOC T&C system shall provide the capability to save sequential print definition files.		Derived	
PRT0140	The MOC shall generate sequential print files from recorded housekeeping data at up to ten times the real-time rate for trend analysis support.	The sequential print files are the collection of telemetry parameters that are used for trend plots, etc.	GSRD	MOC6040
PRT0150	The MOC shall be capable of displaying the currently active sequential print files.		Derived	

3.4.4. Event Messages

Req ID	Requirement	Comments	Source	Source ID
Event Message Requirements				

CHECK THE GLAST PROJECT WEBSITE AT
<http://glast.gsfc.nasa.gov/project/cm/mcdl> TO VERIFY THAT THIS IS THE CORRECT VERSION PRIOR TO USE.

Req ID	Requirement	Comments	Source	Source ID
Event Message Requirements				
EVT0010	The MOC T&C system shall generate and display event messages indicating all command activity, telemetry processing status, limit violations, configuration changes, and all error and warning conditions.		GSRD	MOC5350, MOC9065
EVT0020	The MOC T&C system event messages shall include a UTC timestamp.		GSRD	SYS0040, MOC5350
EVT0030	The MOC T&C system event messages shall include a text description of the event.		GSRD	MOC5350
EVT0040	The MOC T&C system shall display all event messages in RT.		GSRD	MOC5350
EVT0050	The MOC T&C system shall provide the capability to enable event messages.		Derived	
EVT0060	The MOC T&C system shall provide the capability to disable or filter event messages.		Derived	
EVT0070	The MOC T&C system shall provide the capability to filter event messages by type.		Derived	
EVT0080	The MOC T&C system shall save all event messages in event log files.		GSRD	MOC5360
EVT0090	The MOC T&C system shall save all event messages to event log files in the chronological order in which they are generated.		GSRD	MOC5360
EVT0100	The MOC shall provide the capability to display event log files.		GSRD	MOC5370
EVT0110	The MOC T&C system shall provide the capability to print event log files.		GSRD	MOC5370
EVT0120	The MOC T&C system shall provide the capability to start new event log files.		Derived	

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Req ID	Requirement	Comments	Source	Source ID
Event Message Requirements				
EVT0130	The MOC T&C system shall provide the capability to close event log files.		Derived	
EVT0140	The MOC T&C system shall provide the capability to allow other MOC components to inject event messages into the MOC T&C system event log.		Derived	

3.4.5. Autonomous Re-pointing

Req ID	Requirement	Comments	Source	Source ID
Autonomous Re-pointing Requirements				
ARS0010	The MOC shall receive indications that the observatory has executed ARs.		Derived	
ARS0020	The MOC shall retain a log of ARs.		GSRD	MOC4500
ARS0030	The MOC shall create a log entry for each AR.		GSRD	MOC4500
ARS0040	The AR log shall contain the disposition of each AR.		GSRD	MOC4500
ARS0050	The AR log shall contain the status of each AR.		GSRD	MOC4500
ARS0060	The MOC shall maintain the log for the duration of the mission.		GSRD	MOC4500
ARS0070	The MOC shall allow the AR log entries to be viewed.		GSRD	MOC4500
ARS0080	The MOC shall allow the AR log entries to be edited.		GSRD	MOC4500
ARS0090	The MOC shall allow the AR log entries to be deleted.		GSRD	MOC4500

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Req ID	Requirement	Comments	Source	Source ID
Autonomous Re-pointing Requirements				
ARS0100	The MOC shall allow the AR log entries to be created.		GSRD	MOC4500
ARS0110	The MOC T&C system shall create an event message whenever it receives indication that an AR has occurred.		GSRD	MOC4510, MOC5350

3.4.6. Memory Mapping & Maintenance

Req ID	Requirement	Comments	Source	Source ID
Memory Mapping & Maintenance Requirements				
MMM0010	The MOC shall store copies of the downlinked observatory memory dumps.		GSRD	MOC4080, MOC5460
MMM0020	The MOC shall provide the capability to view the observatory memory images stored at the MOC.		GSRD	MOC5460
MMM0030	The MOC shall provide the capability to compare dumped memory images downlinked from the observatory with the associated load images stored at the MOC.		GSRD	MOC5460
MMM0040	The MOC shall accept flight software load requests from the flight software maintenance facility.	Load requests to include: the FSW load and time/conditions to uplink.	GSRD	MOC4040
MMM0050	The MOC shall accept flight software load requests from the GIOC.	Load requests to include: the FSW load and time/conditions to uplink.	GSRD	MOC4040
MMM0060	The MOC shall accept flight software load requests from the LISOC.	Load requests to include: the FSW load and time/conditions to uplink.	GSRD	MOC4040

CHECK THE GLAST PROJECT WEBSITE AT
<http://glast.gsfc.nasa.gov/project/cm/mcdl> TO VERIFY THAT THIS IS THE CORRECT VERSION PRIOR TO USE.

Req ID	Requirement	Comments	Source	Source ID
Memory Mapping & Maintenance Requirements				
MMM0070	The MOC shall provide the capability to replace each instance of the observatory memory image stored on the observatory with an image stored at the MOC.		GSRD	MOC4080, MOC5460
MMM0080	The MOC shall provide the capability of storing, viewing, editing, comparing, and replacing the observatory memory image for the duration of the mission.		GSRD	MOC5460
MMM0090	The MOC shall provide the capability to store a copy of each instance of the SAA boundary definition map stored on the observatory.		GSRD	SYS0230, MOC0090
MMM0100	The MOC shall provide the capability to view each instance of the SAA boundary definition map stored at the MOC.		GSRD	SYS0230, MOC0090
MMM0110	The MOC shall provide the capability to edit each instance of the SAA boundary definition map stored at the MOC.		GSRD	SYS0230, MOC0090
MMM0120	The MOC shall provide the capability to compare an instance of the SAA boundary definition map downlinked from the observatory with the associated map stored at the MOC.		GSRD	SYS0230, MOC0090
MMM0130	The MOC shall provide the capability to replace each instance of the SAA boundary definition map stored on the observatory with a map stored at the MOC.		GSRD	SYS0230, MOC0090

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3.4.7. Limit Monitoring

Req ID	Requirement	Comments	Source	Source ID
Limit Monitoring Requirements				
LMIT0010	The MOC T&C system shall determine the limit states of telemetry mnemonics by comparing observatory data with associated limit threshold values defined in the PDB.		GSRD	SYS0100, MOC0010, MOC5000, MOC5200,
LMIT0020	The MOC T&C system shall determine the limit states of telemetry mnemonics by comparing ground station data with limit threshold values defined in the PDB.		GSRD	SYS0100, MOC0010, MOC5000, MOC5200,
LMIT0030	The MOC T&C system shall automatically determine the limit state for RT data.		GSRD	SYS0100, MOC0010, MOC5000, MOC5200, MOC6000, MOC9000
LMIT0040	The MOC T&C system shall automatically determine the limit state for playback data.		GSRD	MOC5000, MOC5200, MOC9000
LMIT0050	The MOC T&C system shall report limit state changes as event messages.		GSRD	MOC5200, MOC5350, MOC6000, MOC8020, MOC9000
LMIT0060	The MOC T&C system shall require two successive occurrences of a parameter value that is outside of the current limit state before indicating that a limit state change has occurred.		GSRD	MOC5200

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Req ID	Requirement	Comments	Source	Source ID
Limit Monitoring Requirements				
LMIT0070	Once a parameter has gone out of limits, the MOC T&C system shall report the parameter EU value as an event message each time parameter updates.		Derived	
LMIT0080	The MOC T&C system shall provide the capability to reset the limit checking counter when telemetry processing is resumed.	The limit checking counter monitors the number of successive out-of-state occurrences.	Derived	
LMIT0090	The MOC T&C system shall provide the capability to reset the limit checking counter when limit checking is enabled.	The limit checking counter monitors the number of successive out-of-state occurrences.	Derived	
LMIT0100	The MOC T&C system shall provide the capability to enable limit checking of any and all parameters.		Derived	
LMIT0110	The MOC T&C system shall provide the capability to disable limit checking of any and all parameters.		Derived	
LMIT0120	The MOC T&C system shall provide the capability to override the limit threshold values defined in the PDB for any parameter.		Derived	
LMIT0130	The MOC T&C system shall provide the capability to restore the limit threshold values in the PDB for any previously overridden parameter.		Derived	
LMIT0140	The MOC T&C system shall provide the capability to display the currently active limit threshold values for any parameter.		Derived	

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Req ID	Requirement	Comments	Source	Source ID
Limit Monitoring Requirements				
LMIT0150	The MOC T&C system shall provide the capability to display the PDB-defined limit threshold values for any parameter.		Derived	
LMIT0160	The MOC T&C system shall support up to two limit sets for each parameter.		Derived	
LMIT0170	MOC T&C system shall check the value of the switch mnemonic to determine which limit set to use.	The switch mnemonic and the associated switch values are optionally defined for each telemetry parameter in the PDB.	Derived	

3.4.8. Configuration Monitoring

Req ID	Requirement	Comments	Source	Source ID
Configuration Monitoring Requirements				
CFG0010	The MOC T&C system shall provide the capability to define one or more Configuration monitor sets.		Derived	
CFG0020	The configuration monitor sets shall consist of a list of telemetry parameters and associated expected values.		Derived	
CFG0030	The MOC T&C system shall compare the configuration monitor sets to telemetered observatory data.		GSRD	SYS0100, MOC0010, MOC5000, MOC6000, MOC6100

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Req ID	Requirement	Comments	Source	Source ID
Configuration Monitoring Requirements				
CFG0040	The MOC T&C system shall detect differences between the values of the parameters in the configuration monitor sets and the values of the associated parameters in the telemetered observatory data.		GSRD	SYS0100, MOC0010, MOC5000, MOC6000, MOC6100
CFG0050	The MOC T&C system shall provide the capability to compare observatory data to a minimum of 10 configuration monitor sets, simultaneously.		Derived	
CFG0060	The MOC T&C system shall provide the capability for automatic execution of configuration monitor sets.		Derived	
CFG0070	The MOC T&C system shall reject questionable quality data while making comparisons.	Questionable quality is based on R-S check (backup ground stations), CRC (SN), and packet discontinuities.	Derived	
CFG0080	The MOC T&C system shall provide the capability for the user to enable and disable the automatic execution of configuration monitor sets.		Derived	
CFG0090	The MOC T&C system shall provide the capability to automatically execute a comparison whenever the values for all mnemonics in a configuration monitor set have been updated since the last comparison.		GSRD	MOC9000

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Req ID	Requirement	Comments	Source	Source ID
Configuration Monitoring Requirements				
CFG0100	The MOC T&C system shall provide the capability to automatically initiate a comparison whenever the value for of a single mnemonic in a configuration monitor set has been updated since the last comparison.		GSRD	MOC9000
CFG0110	The MOC T&C system shall provide the capability to automatically execute a comparison whenever the value for of a single mnemonic in a configuration monitor set has been updated twice since the last comparison.		GSRD	MOC9000
CFG0120	The MOC T&C system shall provide the capability to automatically execute a comparison at a user-defined interval.	every n seconds	GSRD	MOC9000
CFG0130	The MOC T&C system shall report the results of configuration monitor sets comparisons as event messages		GSRD	MOC5350
CFG0140	The MOC T&C system shall be capable of displaying the names of the configuration monitor sets actively being executed.		Derived	
CFG0150	The MOC shall provide configuration control of configuration monitor sets.		GSRD	MOC0440

3.4.9. Trending & Analysis

Req ID	Requirement	Comments	Source	Source ID
Trending & Analysis Requirements				

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<http://glast.gsfc.nasa.gov/project/cm/mcdl> TO VERIFY THAT THIS IS THE CORRECT VERSION PRIOR TO USE.

Req ID	Requirement	Comments	Source	Source ID
Trending & Analysis Requirements				
T&A0010	The MOC Trending System shall provide data analysis capabilities for the observatory data.		GSRD	MOC0010
T&A0020	The MOC Trending System shall provide the capability to specify a data set based on a user-defined set of mnemonics.	A data set is a user-defined set of telemetry mnemonic values defined by mnemonic name and time.	GSRD	MOC6250, MOC6260
T&A0030	The MOC Trending System shall provide the capability to specify a data set based on a user-defined time span.		GSRD	MOC6250, MOC6260
T&A0040	The MOC Trending System data sets shall have the capability to include observatory HK data.		GSRD	MOC6250, MOC6260
T&A0050	The MOC Trending System data sets shall have the capability to include ground station data.		Derived	
T&A0060	The MOC shall provide the capability to populate the MOC Trending System with data from archived raw frame files.		Derived	
T&A0070	The MOC Trending System shall be capable of storing a subset of observatory HK and ground station data.		GSRD	MOC6250, MOC6260
T&A0080	The MOC Trending System shall be capable of ingesting data sets through an automated procedure.		GSRD	MOC6250, MOC6260
T&A0090	The MOC Trending System shall be capable of ingesting data sets through user requests.		GSRD	MOC6250, MOC6260
T&A0100	The MOC shall make post-pass HK data available for trending within 1 hour of receiving the data.		Derived	
T&A0110	The MOC Trending System shall be capable of storing the ingested data set.		Derived	

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Req ID	Requirement	Comments	Source	Source ID
Trending & Analysis Requirements				
T&A0120	The MOC Trending System shall retain trending data for the past 60 days.		Derived	
T&A0130	The MOC Trending System shall retain statistical trending data for life of mission.	Statistical trending data to include min, max, mean, and standard deviation.	Derived	
T&A0140	The MOC shall provide the capability to re-populate the MOC Trending System with previously deleted data from the archived raw frame files.		Derived	
T&A0150	The MOC shall provide the capability to re-populate the MOC Trending System with 1-day of HK data within 4 hours of receiving a request.	Applicable only when the MOC is staffed.	Derived	
T&A0160	The MOC Trending System shall provide the capability to generate graphical plots of the ingested data.		GSRD	MOC6250, MOC6260
T&A0170	The MOC Trending System graphical plots shall depict mnemonic values versus time.		Derived	
T&A0180	The MOC Trending System shall provide the capability to generate numeric reports of the ingested data.		GSRD	MOC6250, MOC6260
T&A0190	The MOC Trending System shall be capable of generating a graphical plot of from 1 to at least 5 mnemonics simultaneously.		Derived	
T&A0200	The MOC Trending System shall be capable of generating a numeric report of from 1 to at least 5 mnemonics simultaneously.		Derived	

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Req ID	Requirement	Comments	Source	Source ID
Trending & Analysis Requirements				
T&A0210	The MOC Trending System shall be capable of generating a graphical plot of 5 parameters simultaneously at a rate of at least 30 times the real-time rate.		Derived	
T&A0220	The MOC Trending System shall provide the capability to display graphical plots.		GSRD	MOC6250, MOC6260
T&A0230	The MOC Trending System shall provide the capability to display numeric reports.		GSRD	MOC6250, MOC6260, MOC6300
T&A0240	The MOC Trending System shall provide the capability to print graphical plots.		GSRD	MOC6250, MOC6260
T&A0250	The MOC Trending System shall provide the capability to print numeric reports.		GSRD	MOC6250, MOC6260, MOC6300
T&A0260	The MOC Trending System shall provide the capability to save graphical plots to file.		GSRD	MOC6250, MOC6260
T&A0270	The MOC Trending System shall provide the capability to save numeric reports to file.		GSRD	MOC6250, MOC6260, MOC6300
T&A0280	The MOC Trending System shall provide the capability to export numeric reports in ASCII file format.	Provides ability for external analysis applications to access observatory data (e.g., Excel tool).	GSRD	MOC6310
T&A0290	The MOC Trending System shall maintain trends of key parameters for the life of the mission.		GSRD	MOC6270

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Req ID	Requirement	Comments	Source	Source ID
Trending & Analysis Requirements				
T&A0300	The MOC Trending System shall provide the capability to calculate the maximum value of a user-defined parameter over a user-defined time-span.		GSRD	MOC6250, MOC6280
T&A0310	The MOC Trending System shall provide the capability to calculate the minimum value of a user-defined parameter over a user-defined time-span.		GSRD	MOC6250, MOC6280
T&A0320	The MOC Trending System shall provide the capability to calculate the mean value a user-defined parameter over a user-defined time-span.		GSRD	MOC6250, MOC6280
T&A0330	The MOC Trending System shall provide the capability to calculate the standard deviation value of a user-defined parameter over a user-defined time-span.		GSRD	MOC6250, MOC6280
T&A0340	The MOC Trending System shall provide the capability to include statistical values (i.e. maximums, minimums, means, and standard deviations) within graphical plots.		GSRD	MOC6250, MOC6280
T&A0350	The MOC Trending System shall provide the capability to include statistical values (i.e. maximums, minimums, means, and standard deviations) within numeric reports.		GSRD	MOC6250, MOC6280
T&A0360	The MOC Trending System shall provide a WWW interface to allow remote users to create and view graphical plots.		GSRD	MOC6290

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Req ID	Requirement	Comments	Source	Source ID
Trending & Analysis Requirements				
T&A0370	The MOC Trending System shall provide a WWW interface to allow remote users to create and view numerical reports.		GSRD	MOC6290

3.4.10. Anomaly Tracking and Notification

Req ID	Requirement	Comments	Source	Source ID
Anomaly Tracking and Notification Requirements				
ATNS0010	The MOC Anomaly Tracking and Notification System shall maintain a database of all pre-launch and post-launch, observatory and ground anomalies for the life of the mission.		GSRD	MOC9030
ATNS0020	The MOC Anomaly Tracking and Notification System shall allow users to generate anomaly reports.		GSRD	MOC9020
ATNS0030	The MOC Anomaly Tracking and Notification System shall allow users to view the anomaly reports.		GSRD	MOC9020
ATNS0040	The MOC Anomaly Tracking and Notification System shall allow users to edit the anomaly reports.		GSRD	MOC9020
ATNS0050	The MOC Anomaly Tracking and Notification System shall allow users to withdraw the anomaly reports.		GSRD	MOC9020
ATNS0060	The MOC Anomaly Tracking and Notification System shall allow users to print the anomaly reports.		GSRD	MOC9020

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Req ID	Requirement	Comments	Source	Source ID
Anomaly Tracking and Notification Requirements				
ATNS0070	The MOC Anomaly Tracking and Notification System shall allow remote user access to the anomaly reports via the WWW.		GSRD	MOC9020
ATNS0080	The MOC Anomaly Tracking and Notification System shall allow users to generate, view, edit, and withdraw anomaly reports via a WWW interface.		Derived	
ATNS0090	The MOC Anomaly Tracking and Notification System shall automatically receive log or event files from any MOC component.		GSRD	MOC9000, MOC9010, MOC9065
ATNS0100	The MOC Anomaly Tracking and Notification System shall automatically receive indications of anomalous events via email from any MOC component.		GSRD	MOC9000, MOC9010
ATNS0110	The MOC Anomaly Tracking and Notification System shall be capable of receiving log files every 45 seconds.		GSRD	MOC9065
ATNS0120	The MOC Anomaly Tracking and Notification System shall allow a user to define and update a database of keywords, states, values, and categories that indicate anomalous events and their severity.		GSRD	MOC9010, MOC9065
ATNS0130	The MOC Anomaly Tracking and Notification System shall automatically search received log files for anomalous events.		GSRD	MOC7000, MOC9000, MOC9010, MOC9065

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Req ID	Requirement	Comments	Source	Source ID
Anomaly Tracking and Notification Requirements				
ATNS0140	The MOC Anomaly Tracking and Notification System shall identify messages that indicate ARs as anomalous events.		GSRD	MOC7000, MOC4510
ATNS0150	The MOC Anomaly Tracking and Notification System shall identify messages that indicate a pending ToO order from the GSSC as an anomalous event.		GSRD	MOC4400
ATNS0160	The MOC Anomaly Tracking and Notification System shall identify messages that indicate telemetry limit state changes as anomalous events.		GSRD	MOC5200, MOC8020
ATNS0170	The MOC Anomaly Tracking and Notification System shall identify messages that indicate unsuccessful configuration monitoring results as anomalous events.		GSRD	MOC0010, MOC5000, MOC5200, MOC6000, MOC6100
ATNS0180	The MOC Anomaly Tracking and Notification System shall identify TDRSS alert messages as anomalous events.		GSRD	MOC8000
ATNS0190	The MOC Anomaly Tracking and Notification System shall identify missing observatory data messages as anomalous events.		GSRD	MOC2020
ATNS0200	The MOC Anomaly Tracking and Notification System shall identify data quality problem messages as anomalous events.		GSRD	MOC2030, MOC5350

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Req ID	Requirement	Comments	Source	Source ID
Anomaly Tracking and Notification Requirements				
ATNS0210	The MOC Anomaly Tracking and Notification System shall identify a situation where an expected file has not been received within a user-defined time period as an anomalous event.		GSRD	MOC9065
ATNS0220	The MOC Anomaly Tracking and Notification System shall complete searching received files within 15 seconds of receiving them.		GSRD	MOC9065
ATNS0230	The MOC Anomaly Tracking and Notification System shall allow a user to define and update a database containing GLAST team members, contact information, and criteria for notification.		GSRD	MOC7000, MOC8000
ATNS0240	For every anomalous event, the MOC Anomaly Tracking and Notification System shall provide the capability to send notifications to one or more GLAST team members.		GSRD	MOC2020, MOC2030, MOC4510, MOC7000, MOC8000, MOC8020 MOC9065
ATNS0250	The MOC Anomaly Tracking and Notification System shall automatically initiate notifications to applicable GLAST team members within 1 minute of identifying an anomalous event.		GSRD	MOC9000, MOC9040 MOC9065
ATNS0260	The MOC Anomaly Tracking and Notification System shall provide an automatic email acknowledgement of the receipt of a ToO order to the GSSC within 10 minutes.		GSRD	MOC4410

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Req ID	Requirement	Comments	Source	Source ID
Anomaly Tracking and Notification Requirements				
ATNS0270	The MOC Anomaly Tracking and Notification System shall initiate anomaly notifications when the MOC is not staffed.		Derived, GSRD	MOC2020, MOC2030, MOC4510, MOC7000, MOC8000, MOC8010, MOC8020
ATNS0280	The MOC Anomaly Tracking and Notification System shall provide the capability to notify applicable GLAST team members via email.		GSRD	MOC2020, MOC2030, MOC4510
ATNS0290	The MOC Anomaly Tracking and Notification System shall provide the capability to notify applicable GLAST team members via 2-way alphanumeric pagers.		GSRD	MOC2020, MOC2030, MOC4510, MOC7000, MOC8020
ATNS0300	The MOC Anomaly Tracking and Notification System shall receive notification acknowledgements from GLAST team members		Derived	
ATNS0310	The MOC Anomaly Tracking and Notification System shall receive notification acknowledgements sent from GLAST team members via 2-way alphanumeric pagers.		Derived	

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Req ID	Requirement	Comments	Source	Source ID
Anomaly Tracking and Notification Requirements				
ATNS0320	The MOC Anomaly Tracking and Notification System shall send notifications to a secondary GLAST team member whenever notification acknowledgements are not received from the primary GLAST team member within a user-defined period of time.		Derived	
ATNS0330	The MOC Anomaly Tracking and Notification System shall record all notifications sent and all acknowledgements received.		GSRD	MOC9050
ATNS0340	The MOC Anomaly Tracking and Notification System shall display the log of notifications and acknowledgements.		GSRD	MOC9050

3.4.11. Timeline Monitoring

Req ID	Requirement	Comments	Source	Source ID
Timeline Monitoring Requirements				
TMON0010	The Timeline Monitor shall ingest the Integrated Observatory Timeline (IOT).		Derived	
TMON0020	The Timeline Monitor shall create an As-flown Timeline.		GSRD	MOC6150
TMON0030	The As-flown Timeline shall be derived from the observatory housekeeping telemetry.		GSRD	MOC6150
TMON0040	The As-flown Timeline shall include a description of observations that were actually executed by the observatory.	This should include ToOs and auto repoints.	GSRD	MOC6150

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Req ID	Requirement	Comments	Source	Source ID
Timeline Monitoring Requirements				
TMON0050	The MOC shall create an as-flown timeline following each TDRSS or ground station pass.		Derived	
TMON0060	The MOC shall generate reports to allow confirmation of command execution to account for any commands that have not executed.	Applies to both stored and real-time command execution.	GSRD	MOC6200

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<http://glast.gsfc.nasa.gov/project/cm/mcdl> TO VERIFY THAT THIS IS THE CORRECT VERSION PRIOR TO USE.